Electrical World

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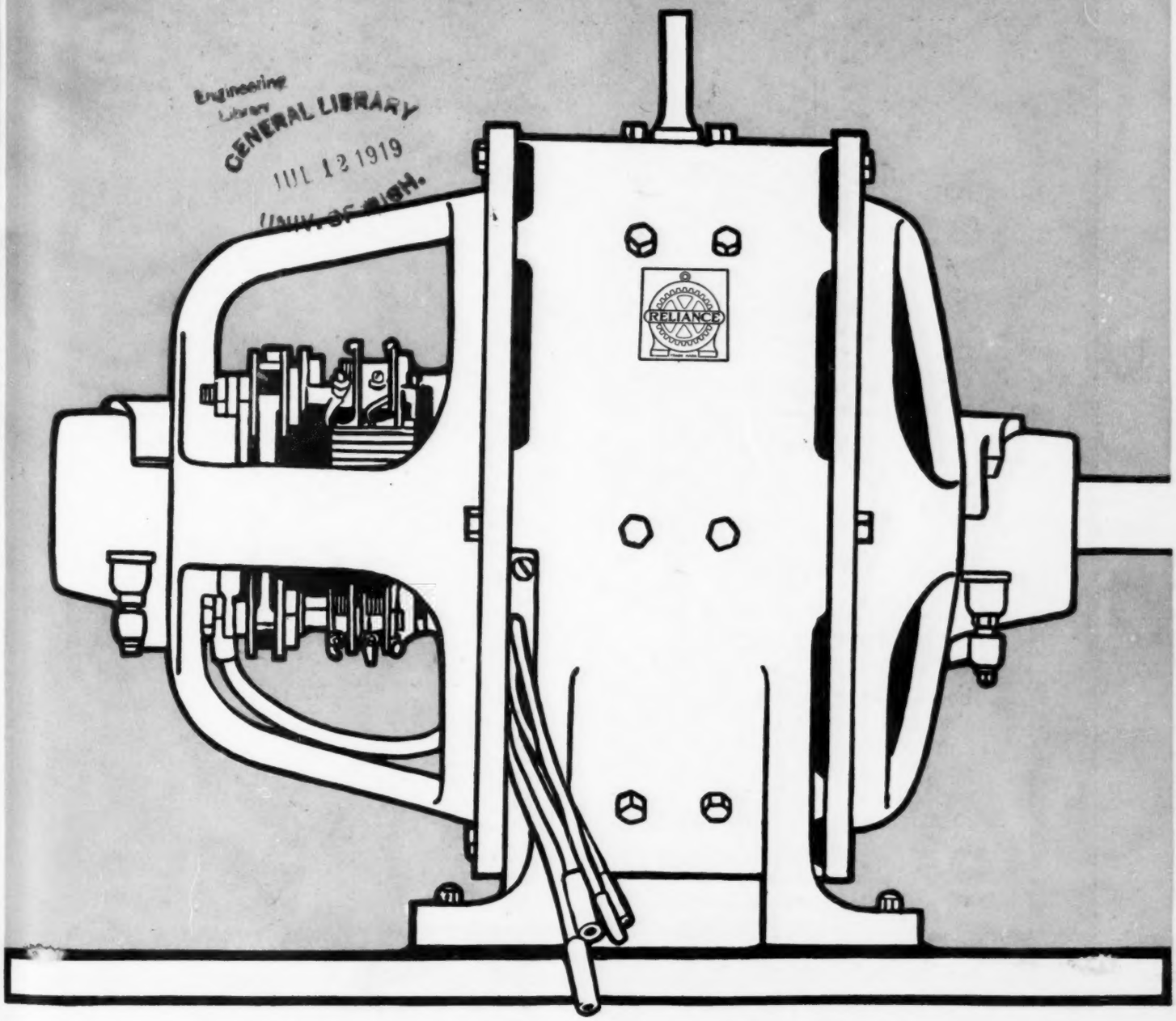

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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A. I. E. E. Development Plans

The general spirit of unrest which has swept across the world has not left our national engineering societies untouched. The development committee of the American Institute of Electrical Engineers, therefore, has canvassed the various sections for suggested changes and embodied these in recommendations to the Board of Directors. However, the discussion at Lake Placid meeting was such as to indicate both a lack of appreciation and of knowledge of the character of the changes recommended and a fear that something radical and even revolutionary was contemplated. In view of this feeling it would be rather unwise for final action to be taken on the recommendations of the development committee without the fullest and frankest discussion by the entire membership. Such a procedure would certainly result in a better understanding of what it is proposed to do and would be for the best interests of the engineering profession.

Production must increase per unit of cost if America is to forge ahead in this critical era. No other known method offers so effective a solution of the problem of finally reaching a lower price level without doing injustice to both labor and capital. Hard work, yes, drudgery, will always be necessary, but how both may be lightened by electrical aids!

Up to the Commissions

STATE commissions, which were dangerously threatened by the concentration of power in federal authorities during the war, are factors of very large importance in the uncertain conditions of public utility operation which still prevail. These regulating bodies tried to maintain their general authority and standing in war time and they are returning to the pre-war forms of regulation. As the direction of the various classes of utilities which were operated by the government as a war measure passes again to the private owners, problems of vital concern will arise for the commissions to meet. Fortunately for the electric utilities, their affairs are not complicated at this juncture by a mixture of arbitrary government management with the purely economic issues of the times. But they have serious matters to settle which in part are shared in common with the other classes of utilities. Questions of supply of capital, rates for service and return on capital, operating expenses under present high costs, relations with employees, and public relations are matters of management which touch all of the utilities and the commissions. Upon a sympathetic understanding of the nature and extent of these problems by the members of commissions, much depends of weal or woe for the public utilities.

One of the main sources of difficulty in the immediate situation has developed logically from an erroneous expectation in regard to operating costs. Many managers calculated that high material and labor costs represented a war-time phenomenon which would pass with the end of hostilities or shortly thereafter. This was also the belief of commissions, for in granting authority to increase rates, they usually confined it to a limited period. Now it is seen that the war subcharges are fair also in peace. Since both managers and commissions have failed to gage correctly the duration of the period of high costs, there will have to be a revision of opinion if justice is to be done. It would be folly to attempt to cloud the issue by saying that costs ought to go down. The facts are that costs of operation are still on a basis which in many cases justifies rates higher than the pre-war level. No element of the consuming public is so blind as to fail to appreciate that this condition exists in virtually all industries. There is a responsibility upon both companies and commissions in meeting the situation thus created. Upon the officials of companies an obligation lies to present before the public, by printed advertisement and word of mouth, the convincing array which their own books contain. And the responsibility resting upon the commissions to accept the facts as a basis for rate making under present high costs is unescapable.

Generally the reasons which were advanced in favor of regulation in the days when that policy was new related to the protection of the public from unjust practices by the companies. Regulation was adopted because it provided in theory a method of assuring unprejudiced review of the affairs of companies engaged in public utility service. That is still a sound theory so far as it goes. It was also the intent, however, that regulating commissions should protect the companies against excessive demands from the public. Certainly it is the function of the commissions to decide justly as between the suppliers of service on the one hand and the users of service on the other. When central station companies made their own rates before the era of regulation the trend was downward. This was due to economies in operation, to improvement in apparatus and to larger volume of output. Under regulation, the trend continued to be downward until the war. Now the downward trend has been checked, and from the present outlook the tendency so long as costs stay high will be to higher than pre-war rates if the credit position of the companies is to be properly safeguarded. We are still in the period of private ownership and operation with public regulation, and this policy has been tested and not found wanting. The radical change in conditions should not be allowed to imperil regulation as a valuable feature of government.

Standardized Industrial Lighting

THOSE of our readers who are interested in industrial construction will find much of iterest in H. L. Cornelison's paper on the standardization of the lighting and wiring equipment necessary for such use. One must, of course, start out by realizing that buildings of different construction devoted to different uses, do not lend themselves readily to a uniform type of equipment. There is, however, a certain community of design between buildings for manufacturing purposes which enables one to apply a similar community of design in a good many instances. There have been a considerable number of attempts to reduce industrial illumination to rules and orders, which are of very real assistance to the engineer even although they cannot suitably meet with universal application. Mr. Cornelison's studies pertain especially to buildings of the usual bay construction in which the bays approximate the dimensions frequently used. For such cases and for various intensities of illumination up to six foot-candles, about the maximum necessary in this class of work, he has worked out the suitable distribution of light as to size of units and number of outlets per bay in a way which enables both wiring and lighting equipment to be approximately determined subject to the usual qualifications.

Where a building follows standard lines and is to be used permanently for a particular class of work, the data furnished are in extremely convenient form and fairly full. Change of use will probably imply modifications of intensity which are easily made, or of distribution, which are not easily made and may require considerable modifications in the schedule, particularly in the character of the reflectors used. It is not an easy task to standardize reflectors for use in high and low buildings, and for various requirements as to distribution. The type here taken as characteristic is a good and useful one for general purposes, although cases will arise where radical change may be necessary, particularly if vertical working surfaces have to be considered or if there is an unusual amount of fine detail. The best one can do in standardizing is to work out a sound specification for average conditions, and that Mr. Cornelison has accomplished. Modifications necessary to adapt a building to new or special uses are, as always, a matter of shrewd detailed engineering if the most efficient and economical results are to be attained. The one note of warning which we would emphasize is that changes of use or rearrangement of equipment generally carry with them modification of the lighting outfit. Finally, since construction in industrial buildings is such as to make changes in wiring difficult, it is better to err, if at all, on the side of too many outlets rather than too few.

"Business is better." It sounds first rate, but what does it mean? Does it stand for a business that is better simply because the electrical industry grows? Or is it a business improvement that has resulted from systematic planning, hard work and patient reaping?

A New Tarriff Wall

AN IMPERIAL preferential tariff, it is expected, will be enacted to protect the large markets for all classes of products which exists in the various countries composing the British Empire. This will, of course, apply to Canada as well as the other parts of the empire. Canada has for a long time been a very important outlet for electrical goods manufactured in the United States. A tariff may afford sufficient preference to British-made goods in Canadian markets to require the establishment by American lectrical firms of Canadian factories. Already there a e a number of such factories in Canada. More may be expected to follow.

With the English dirigible returning through the air, using wireless telegraphy and the President aboard a naval transport, telephoning by wireless, electricity has a part in the events of the week. People look to electricity for novel developments and its universal adaptability and application to make it useful everywhere.

Maintaining High Tension Service

THE one thing uppermost in the minds of the managements of all high-tension transmissions is the necessity of maintaining continuous service for their customers. Notoriously unreliable transmission plants are now very unusual yet accidents do happen and every effort must be made toward averting them as far as is humanly possible. In the current issue Mr. Drabelle, who has professionally found the problem in concrete form, gives some extremely useful suggestions as to common causes of difficulty. These, of course, vary from place to place and according to the construction of the lines concerned. But care and caution must be depended upon in every instance to secure operation all day and every day in the year. We would emphasize particularly Mr. Drabelle's remarks on cheap insulators. What is wanted for high-tension work is an insulator of the very best quality which can be obtained, designed with an ample factor of safety for the voltage requirements. Since the cost of replacement, to say nothing of the troubles which that replacement signifies, is largely compared with the mere price of the insulator, the moral is plain that it is good economy to purchase insulators of a grade not likely to require replacement. On the whole there has been a great improvement in insulators in recent years, but only thorough testing and full information as to the operating qualities of the type selected can insure the possession of a really first-class article.

The suggestions for line patrol and emergency repairs are much to the point. It is not desirable to operate a long line with reserve supplies kept at its ends and imperfect means of communication and transportation. If anything happens it is necessary to get help and material at the nearest point possible and the suggestion of locally carrying and keeping up a small supply of the most necessary line replacements is much to the point. Particular attention is called to the necessity of looking out for fire in case of wooden pole lines which have often suffered from brush or grass fires started merely for clearing purposes or by accident. A treated pole well set, with bushes thoroughly cleared away from around its base and surrounded by a ring of gravel or earth upon which grass is not allowed to flourish will generally secure immunity against accidental fires, and it should be part of the patrolman's duty to see that the bases of the poles are clear of inflammable material. To put the matter in a nutshell the price of continuous service is line material of the best quality plus continuous patrolling.

A Well-Planned Station

A PLANT the size of the Erie (Pa.) station described in our columns this week by Mr. Scott can no longer claim distinction merely from size, but this one is of more than passing interest, especially in the admirable economic results which have been obtained. Erie as an industrial center has been rapidly expanding, and two years ago the lighting company had outgrown its station and its site, and had already started to develop a new site of large possibilities. The war came on with an acute demand for more power, and the station here noted was actually put into operation in ten months from the time the ground was broken, getting to work on the tenth of February 1918. It is regarded as merely the first unit of a much larger development, but is complete in itself. The fuel supply comes from the Pittsburgh district by rail and for the present station equipment 5,000 tons outdoor storage capacity is provided, with more than 1400 tons in the overhead bunkers. A locomotive crane stores and reclaims the main fuel supply, and belt conveyors carry it, after passing by other conveyors through the crusher, to the suspended bunkers in the boiler houses. The boilers are larger for a plant of this size than are usually found, six units taking care of the entire output, and they are notable in being designed for 250 lb. (17.5 kg.) pressure and 200 deg. (111 deg. C) superheat, following the path of advanced practice which is now beginning to show well beaten through the dead level of over-cautious standardization.

The power units are two horizontal turbo-generators, one of 7500 kw. and the other 10,000, rated at 80 per cent. power factor. The pair are practically independent of each other from the coal bunkers to the outgoing leads, but provision is made for cross connecting the system at all important points. The auxiliaries are in duplicate, partly steam and partly electric, an arrangement which facilitates the maintenance of good economic conditions under all loads. The electric equipment is comparatively simple and the feeders are all underground. No reactors are installed in the feeders but provision is made for reactors in the main bus between the section which constitutes the present plant and future sections.

It is worthy noting, that generator protection is installed in the form of high-current and low-voltage relays, so that if a short circuit occurs the voltage regulator is thrown out of circuit and the entire field resistance is thrown into the exciter. It is probable that a similar device will be applied to the future main bus, cutting it loose under the action of high-current and low-voltage relays, a combination which gives every indication of being particularly effective as a remedy for troubles inside a station. The whole switch board equipment is operated by remote control and a good factor of safety is provided in all switch board apparatus, since all the bus supports, disconnecting switches, circuit breakers, and the like are for 15,000 volts, although the system voltage is but 7200. From a practical operative standpoint the actual performance of the station is striking, since the steam per kw. hour is held down to 13.65 lb. (6.2 kg.) and the coal burned to 1.81 lb. (0.82 kg.) while the boiler efficiency is a shade over 70 per cent. These figures are sufficient comment on the skill with which the station was planned and operated, and the importance of high pressure and superheat in cutting down fuel consumption. This is but the beginning, which may probably grow to one of the large stations of the country, but it is a mighty good beginning and future sections may reasonably be expected to improve even upon the operative success here attained.

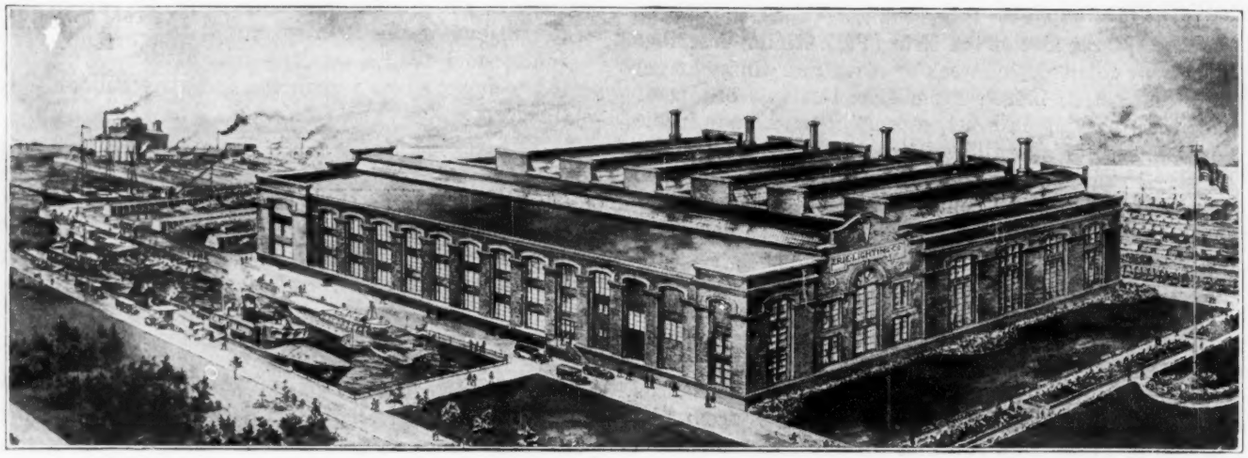
Although electrical development in the British Isles is far behind that of this country, the growing appreciation of neglected opportunities there points to corrective action. Government stimulus is relied on there to do what was done here on personal initiative.

The Continuous-Rated Motor

THE electric motor should give satisfactory performance under all reasonable conditions of normal use. That is to say, it should be capable of giving good service, summer and winter, in a warm engine room or in a cold-storage vault. Moreover, it must be capable of being shipped to any part of the world and of performing its duties in any locality, regardless of latitude or longitude.

It is not only necessary that a motor should be rated by the manufacturer in such a manner as to give good satisfaction under all reasonable conditions of service, but it is also necessary that the rating should be established according to internationally approved standards. It is very undesirable, from the standpoint of world progress and civilization, that motors constructed in different countries, for a steady output, should differ materially in their behavior and especially in their thermal behavior. The rules of good international rating should be internationally established and universally recognized, otherwise a great variety of complaints, disagreements and mutual misunderstandings are likely to occur between the users of electrical machinery in different countries.

The American Institute of Electrical Engineers has coöperated with the International Electrotechnical Commission in seeking to arrive at a universal international agreement upon the conditions for rating electrical machinery. A maximum temperature for the hottest internal spots of the windings has been very generally agreed to, and the method of arriving at the hottest spot by thermometers or other means has been established by allowing a certain margin for security, after measuring the temperature of accessible points in the winding. The ambient temperature of 40 deg. C., has been adopted by the A. I. E. E. and has also been recommended by electrical societies in a number of other countries, but has not yet been internationally adopted. The Electric Power Club has also adopted as "recommended practice," a departure from its standards in the case of 50 deg. C. general purpose motors. Although some objection has been raised to 40 deg. ambient temperature, in view of the lower average temperatures in the temperate zones, yet it has been proved that machinery built for the temperate zones may be purchased and installed in the tropics; and, moreover, machinery designed for this service in the United States may happen to be installed in warm engine rooms. Consequently, the rated ambient temperature of 40 deg. C. is none too high for the incidents of modern applications and tends to prevent all the annoyance which would accompany the necessary derating of machines installed in warm localities if the ambient temperature were set at, say, 30 deg. C.



Northwest Pennsylvania's Newest Station

This Power House Embodies the Latest Ideas of Tested Engineering Practice—Built on the Unit Principle—The Installation Will Eventually Be Rated at 120,000 Kw.

BY J. B. SCOTT
Engineering Staff of Day & Zimmermann, Inc.

BEGINNING with a small but strictly modern station in 1912 and expanding at an average rate of 250 per cent per annum, the Erie (Pa.) Lighting Company found itself confronted in 1917 with the fact that it had outgrown not only its station but also its site. In order to develop on broader lines, a magnificent waterfront property was acquired, having possibilities of an ultimate development of 120,000 kw. The station which has been completed is the first unit of the ultimate development, but the present and each succeeding unit will be complete in itself.

Reliability of service was the first consideration in the design of the station, the second being over-all operating economy. As the project was a strictly commercial one, no attempt was made in the design to do any pioneering in the construction, layout or equipment of the plant, but the latest ideas of tested engineering practice were applied in every instance.

Fuel and Ashes.—All coal is delivered by rail, the best available supply coming from the Pittsburgh district. Ample provision is made for outdoor storage and reclaiming, for which a 20-ton eight-wheel locomotive crane is provided. The coal supply throughout is handled mechanically, the equipment comprising a track hopper, an apron conveyor, a crusher and a pivoted bucket elevator and conveyor. The latter discharges upon three belt conveyors, which distribute the coal in the suspension-type bunkers above the firing aisles of the boiler house. From the bunkers the coal is distributed to the stoker hoppers through motor-operated weighing larries.

Ashes are dumped from the stokers into brick-lined steel-hoppers, from which they are discharged into industrial railway tip cars and elevated to the yard level, where they are used for filling low ground surrounding the property. When this ground has been filled an elevated concrete bunker will be constructed, for which the present elevator will be available, and the ashes will be discharged into railroad cars for shipment to other localities.

Boiler Plant.—Six 846-hp. Babcock & Wilcox longitudinal-drum boilers have been set singly in brick settings. Each boiler is equipped with two seven-retort Taylor underfeed stokers, set one in front and one in rear of the boilers, with 15-ft. (4.5-m.) furnace height. A drop-leg header construction and a horizontal baffle above the first row of tubes permit the radiant heat from both stokers to impinge on these tubes along their full length. The boilers are designed for 250 lb. (17.5 kg.) working pressure and 200 deg. Fahr. (111 deg. C.) superheat. Three forced-draft fans are provided, one of which is a spare.

From each boiler the flue gases pass through unit economizers or may be by-passed directly into one of the two main flues. Each main flue is provided with duplicate induced-draft fans and a short steel stack.

Each boiler is equipped with a complete set of indicating and recording instruments as follows: One G. E. indicating, integrating and recording flow meter; one Uehling CO_2 recorder; four "Precision" draft gages; two recording thermometers for flue-gas entering and leaving economizer; one recording thermometer for feed water leaving economizer; one recording thermometer for steam, and recording thermometers for feed water entering and leaving the feed-water heater. All the thermometers are of the Bristol type. The instruments are mounted on panelboards conveniently situated for the observation of the firemen.

The make-up supply for the feed water is treated by a Sorge-Cochrane hot-process purifier so that no raw water can enter the boilers at any time. The boiler-feed pumps are of centrifugal type. The pressure in the feed lines may be adjusted to any desired amount by means of a Schade excess-pressure regulator and governor.

Turbine Plant.—The first unit section of the ultimate plant contains one 7500-kw. and one 10,000-kw. (maximum rating at 80 per cent power factor) turbo-generator. Each unit represents practically a complete independent power plant in itself from coal bunkers to

outgoing feeders but cross-connected at vital points with the adjoining main unit. Practically all the auxiliaries for each turbine are in duplicate, being divided between steam and electric drive in most cases. By this means the heat balance of the plant may be adjusted and the over-all station economy maintained at a maximum under varying conditions of load.

The 7500-kw. generator now installed at the Front Street was originally ordered for Peach Street station, but the power business developed so rapidly that a 10,000-kw. unit was purchased before the 7500-kw. generator had been delivered. It is now planned to make the 10,000-kw. unit standard for the new station.

Surface condensers are installed with each turbine, the centrifugal circulating pumps being placed several feet below the mean lake level; hence the pumps start up under a positive suction head. The ends of discharge lines are submerged to permit utilizing the siphon effect. The circulating-water system as a whole is an exceptional one—the intake is at the docks of the Anchor Line Steamship Company, where a mean depth of over 20 ft. (6 m.) of water is available. Coarse racks are provided at this point to prevent the entrance of floating timber. The water is conducted through a reinforced concrete conduit 5 ft. by 6 ft. (1.5 m. by 1.8 m.), approximately 500 ft. (150 m.) in length. Finer racks are provided in a clean-out well just outside of the power plant, and traveling screens for removing the smaller sizes of débris are located inside the plant, where the operators are protected from exposure in severe weather. Chain hoists allow the screens to be raised for inspection and repairs. For removing the finest débris from the hurling water of the centrifugal air pumps, twin suction strainers of ⅛-in. (3.2 mm.) mesh are provided.

The generator air intakes are provided with individual air washers having movable louvers operated by thermostat-controlled motors, so that the possibility of freezing the spray in severe weather is avoided. The heated air from the generators is discharged in close proximity to the intakes of the forced-draft fans for the boilers, thereby utilizing a portion of the heat which would otherwise be wasted and reducing the amount of cold air drawn into the boiler-room basement in severe weather.

The electrical layout in general is explained by the accompanying drawings. Each generator feeds direct to a generator bus where provision is made for the generator current and potential transformers; taps are made through oil circuit breakers to the east and west main bus. All outgoing and station supply feeders are controlled by General Electric H-6 oil circuit breakers so connected through selector disconnecting switches as to enable them to be supplied from either main bus.

In order to insure against the possibility of an interruption through the failure of a feeder circuit breaker, two transfer or reverse buses have been provided. Each is controlled by its respective oil circuit breaker and disconnecting switches, enabling power to be supplied from either main bus. By means of the double-throw disconnecting switches at the head of each feeder, power can be taken from either the main or transfer bus.

Current transformers are inserted in each leg of the feeders in the basement immediately above the potheads with the exception of those supplying station power, which are installed in transfer lines. These supply the energy for the meters and relays. Relay protection is provided by General Electric IA relays of the inverse-time-element type. As all feeders are underground, protection against voltage and frequency transients is provided in the form of static lightning arresters on each main and transfer bus.

Potential for synchronizing and Tirrill regulators is provided from each bus. Two sets of Tirrill regulators are so connected by interlocking switches that one regulator can handle both main buses when in parallel, or one regulator can be used for each bus when operated separately.

Provision is made, as indicated by the dotted portion of the main bus, for a bus-tie oil circuit breaker in each section, and main-bus oil circuit breakers between the first and second sections, to be used when the second unit of the plant is built.

The installation of generator and feeder reactors received careful consideration, as such equipment has in many cases given poor results and caused extensive damage, owing to all sides of the question not being fully weighed. Finally it was decided to install reactors in the main bus between the first and future second sections, thus preventing the generators on either section from pumping into a short in the other section.

To protect the generator in one section from a short on a cable or bus in the same section, high-current and low-voltage relays were installed in the generator leads with the secondary contacts so connected that upon the occurence of a short circuit the Tirrill regulator is cut out of circuit and the entire exciter field resistance cut in. Therefore the most important factor in build-

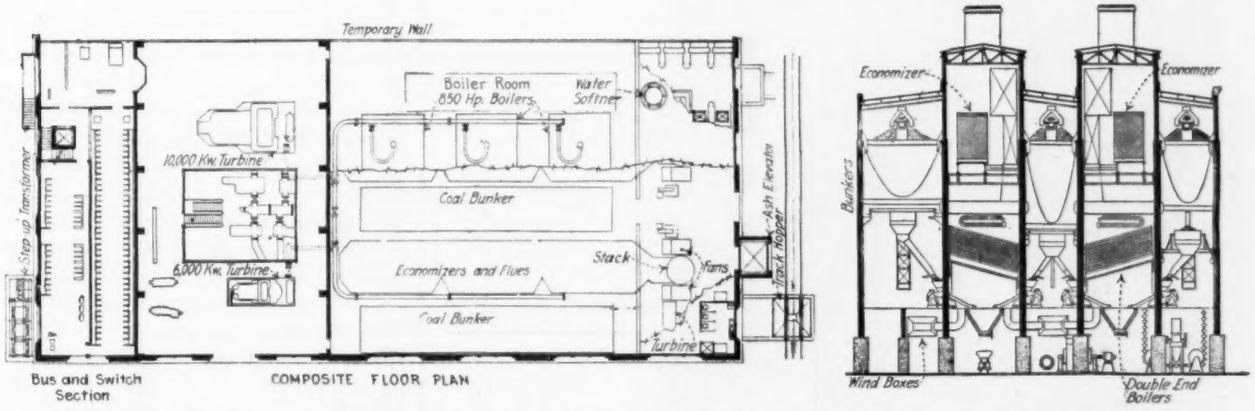


FIG. 1—PLAN AND CROSS-SECTION OF ONE UNIT OF NEW ERIE (PA.) POWER STATION SHOWING DOUBLE-END BOILERS

ing up and sustaining a short circuit—the Tirrill regulator and low resistance exciter field—is promptly and automatically adjusted. At present consideration is being given to a further application of this principal of sectionizing by providing the main-bus sectionizing switches between sections 1 and 2 with automatic tripping from the high-current and low-voltage relays. This would entirely segregate sectional troubles and prevent more than a momentary unbalance of that section not in "fault."

In each section of the plant—bus room, turbine hall, boiler room, etc—certain lighting fixtures are at all times energized from the storage-battery system so that in case of failure of the normal alternating-current lighting source from any cause whatever there will be sufficient illumination for the operators to restore the system to normal.

The switchboard and all equipment is of the remote-control type. The main or generator board is of the bench type, while the feeder and exciter boards are of the vertical type. These three units are arranged on three sides of a square, with the operator's desk and telephone exchange on the fourth side.

The backs of the switchboards contain a number of features of interest from both engineering and safety standpoints. Recognizing the fact that the modern remote control boards contain more wires than can conveniently be arranged by the usual type of spaced cleat, a special box type of cleat was made on the premises which allows of neat and compact assembly. All wires of the same type and performing the same function are in the same place on each panel, thus greatly facilitating the tracing of trouble. The synchronizing and direct-current control buses are of $\frac{3}{8}$-in. (9.6-mm.) copper tubing supported on fiber cleats, to which tap wires are attached by sweating into a drilled hole.

The most important feature is the terminal block shown at the bottom of the board immediately above the conduits. These were designed by the engineers and fabricated on the job. All wires from the conduits terminate in the lower portion of the terminal block and the wires from the board in the upper portion. These terminal blocks are so designed that a short circuit cannot be made either across the front or top, and at the same time they make possible easy disconnection for testing either up the board or down to the instrument transformer or other devices. It was recognition of the trouble encountered with the usual soldered joint that prompted the design and installation of this feature.

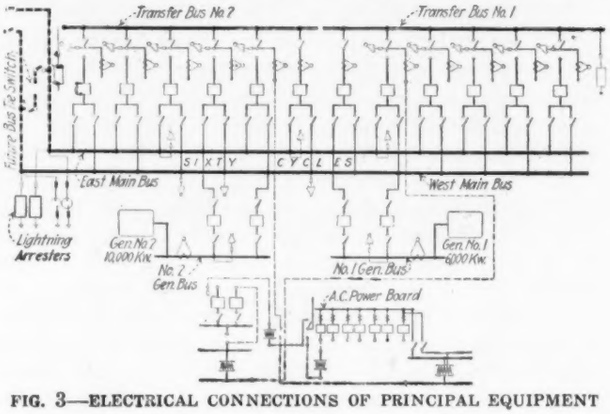


FIG. 3—ELECTRICAL CONNECTIONS OF PRINCIPAL EQUIPMENT

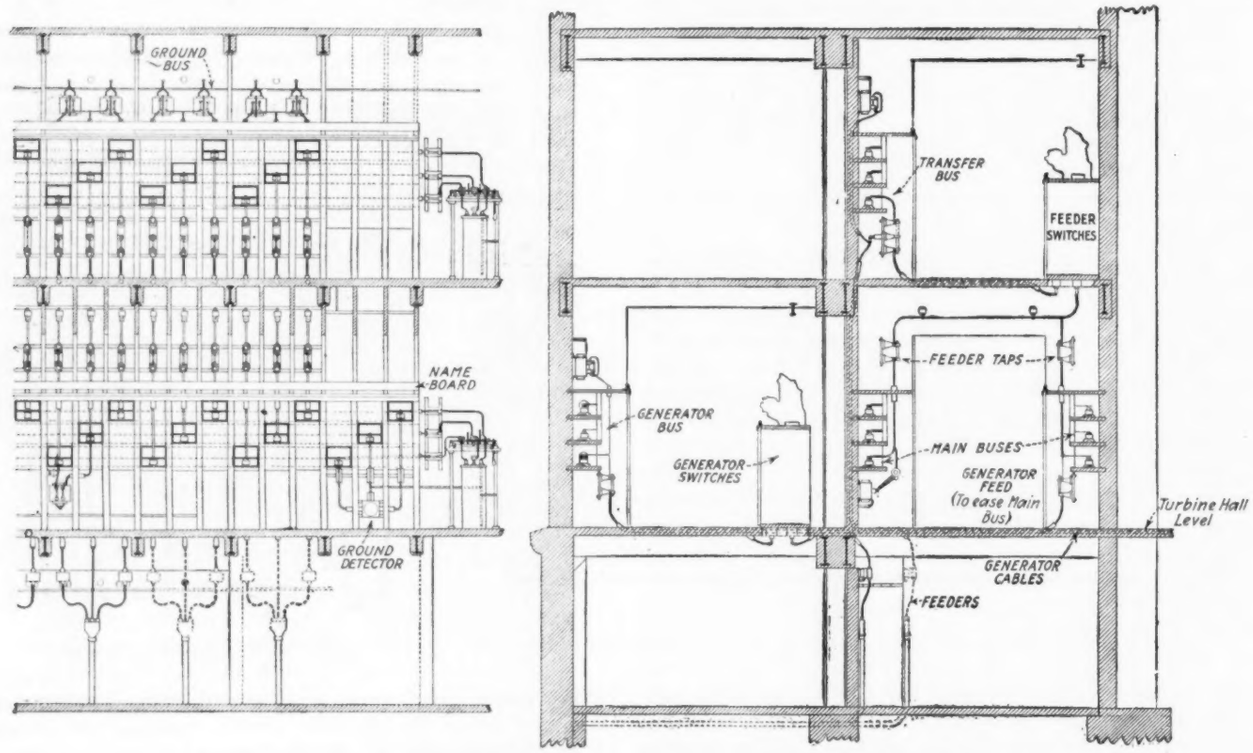


FIG. 2—PORTION OF LONGITUDINAL SECTION AND CROSS-SECTION THROUGH ELECTRIC BAY

All feeders are supplied with current and potential switches on the front of the board so arranged and connected that the watt-hour meter can be entirely disconnected for periodic test, but leaving all other instruments in circuit and operating. Thus it is unnecessary for the tester to disconnect any wires at the meter or

on the board, it being necessary only to attach the test leads to the free terminals of the switch after being thrown to the off position.

The control circuits on the front of the boards as well as their fuses on the rear are designated by black fiber nameplates with white recessed letters.

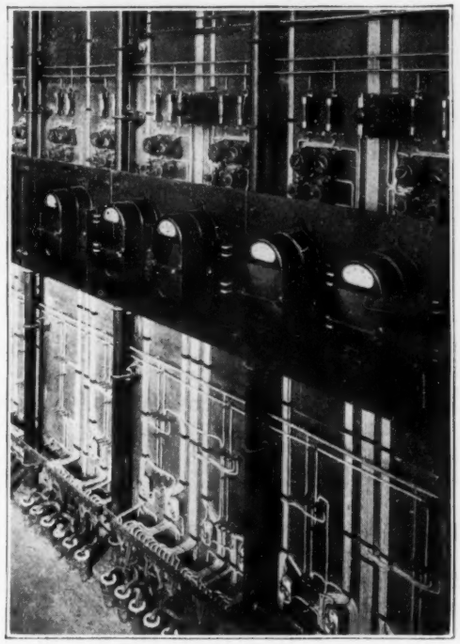


FIG. 4—ARRANGEMENT OF INCOMING CIRCUITS AND BACK-OF-BOARD WIRING

All bus structures are carried in compartments made up of Alberene stone shelves set in the main and partition walls and are supported by vertical brick barriers carried from the floor to the top Alberene stone shelf. From this point up and across the ceiling the barriers are of the "make-up" type, being of concrete plaster, 4-in. (10-m.) thick on reinforced expanded metal. In this upper portion are the disconnecting switches from which feeder taps run to the bottom of the oil switches, thus completely isolating each phase. To prevent the spread of explosions and fire all openings in the bus not entered by taps are covered with a heavy transite board which is removable for repairs. The lower portion of the bus structure is equipped with doors. Between each phase the vertical barriers are painted red, plainly designating each feeder in addition to the name board placed above the doors. On the main bus structure the potential transformers are placed in separate compartments below the bus proper, while on the generator and transfer bus structures they are placed in compartments above the bus.

The generator, main and transfer buses are of copper bar, while the feeder taps are of copper tube. All bus supports, disconnecting switches, bushings and oil circuit breakers are for 15,000-volt service, giving a good factor of safety over the normal system voltage of 7200.

Owing to war conditions the lower Alberene stone for the oil switches could not be secured, resulting in the design of one of reinforced concrete. Considerable study was given to the problem of inductance and heating due to eddy currents in the reinforcing bars together with the requisite strength. These have been very successful in capacities up to 2000 amp. and have proved to be considerably stronger than Alberene stone.

While all conduits for control and instrument transformer secondaries are carried in the walls and concrete floors, in no case are they placed over or under ducts carrying high-potential cables for the reason that of late some serious shutdowns in large plants have been in large part caused by faults in the high-tension

OPERATING RESULTS OBTAINED AT THE ERIE PLANT

Steam per kilowatt-hour, station rate	13.65 lb.
Coal per kilowatt-hour	1.81 lb.
Actual evaporation of water per lb. coal	7.54 lb.
Factor of evaporation	1.22
Equivalent evaporation	9.20 lb.
Boiler efficiency	70.34 per cent.
Coal	12,691 B.t.u.

cables burning off the control ducts of other feeder circuits where they were over or under the high-tension cable.

All insulators not a part of the bus system proper, such as those in the ceiling barriers, and all disconnecting switches, are carried on pipe framework. This insures against the possibility of a short circuit burning the bolts or the plate setting in the wall, in which case it would be extremely difficult to remove and replace the defective part were the attachment made directly to the wall or ceiling. All grounding is accompanied by means of $\frac{3}{4}$-in. by $\frac{3}{16}$-in. (19.2-mm. by 4.8-mm.) copper bar.

None of the auxiliary motors in the plant are provided with fuses or exposed switches, all protection

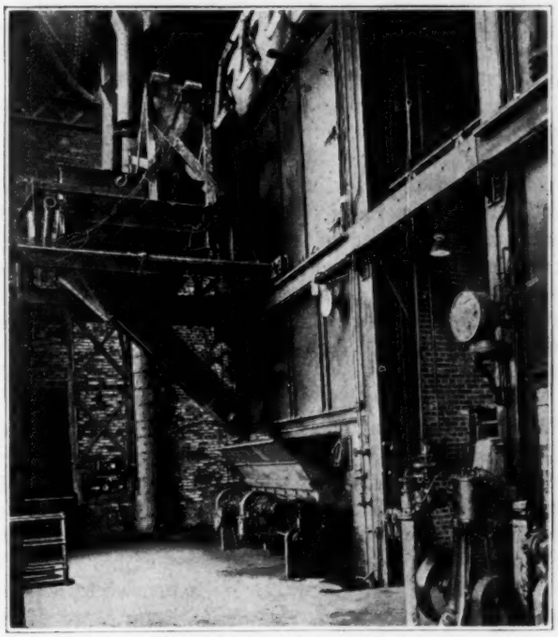
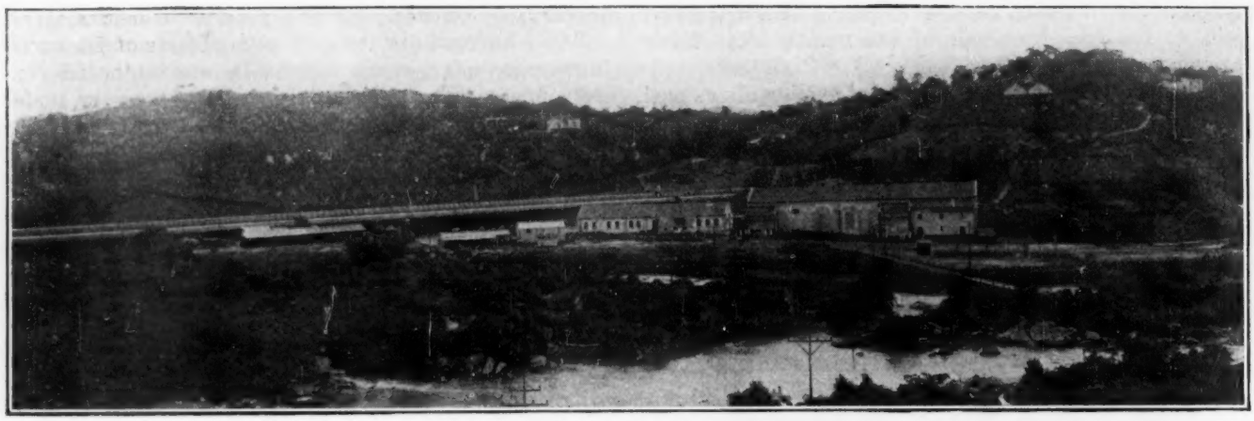


FIG. 5—ONE OF THE 850-HP. BOILERS HAVING STOKERS ON BOTH ENDS

being accomplished by means of relays in connection with auto-starters or automatic oil switches. All switches are of the safety type.

Because of the size of the generating units and the fact that this is the most economical station, the Erie Lighting Company will carry its base load on the new plant with the highest load factor attainable.

Day & Zimmerman, Inc., were consulting engineers.



POWER PLANT NEAR PARNAHYBA, BRAZIL

Export Conditions for Electrical Products

Summary of Information on South American Countries Emphasizes Element of Financing in Sales of Manufactured Materials for Public Utility Use and Water Power Possibilities—Sweden's Large Development

EXPORT possibilities for the electrical manufacturers of this country and the general status of electrical development in foreign countries are receiving much attention here. To emphasize the breadth of present and projected electrical developments in South America and stimulate active interest in export opportunities, the Guaranty Trust Company of New York has issued a pamphlet embodying results of a study of available information. It is entitled "The South American Market for Certain Electrical Material." A similar pamphlet has been issued by the same company on "Swedish Developments in the Use of Electric Power."

A foreword to the study of South American conditions emphasizes the extraordinary upsetting of the normal world sources of supply and demand for electrical machinery and material and, in sharp contrast to the collapse of the vast German trade in such commodities, the steady growth of our own overseas shipments in these lines.

PAINSTAKING STUDY NECESSARY

"We must recognize," says the company, "that our present commanding position in this branch of foreign trade and the world-wide distribution of our goods have been as much the result of circumstance as of intensive effort on the part of our producers and exporters. Under peace conditions we cannot hope to expand our foreign markets, or even to maintain them, unless we are prepared to devote to them more of the painstaking intensive study of shipping, packing, distributing, and financing which has characterized the success of our competitors. We must be more liberal in our credit terms, and more ready to meet local conditions and prejudices. And, finally, we must consolidate our position by a broader investment of American capital in foreign enterprises.

"Given such attention, and with the quality of our goods maintained at the highest possible standard, we can face the inevitable renewal of competition without fear of the results. There is today a vast stored-up demand abroad for electrical material of all kinds, and the return of normal conditions should increase rather than diminish the call."

Two factors which will play a dominant part in South American purchases are mentioned. The first is that South America does not produce any of the electrical materials. Second, nearly all of the companies are financed by foreign capital and the almost irresistible tendency is for them to purchase their materials in the country from which the capital comes.

"British capital," it is stated, "is responsible for the largest proportion of these public utility corporations. The French entered the field perhaps as early as the English, but have not been so successful, and their influence has not grown so fast and so extensively as the English. The Germans entered later, but have been very successful, and during the years preceding the war their enterprise in these respects was undoubtedly gaining them a position of very substantial importance. This was particularly evident in some parts of Brazil and Chile, and in Argentina.

"Naturally such companies purchase their equipment and supplies in the home country. Frequently it is part of the stipulation on which the bond holders advanced money, that all supplies should be so bought. Generally the purchases are not even made locally, but through a purchasing office in London, Paris, or Berlin.

"This is not to say that American material absolutely cannot be sold to such concerns, but, in order to be sold it must present some very decided advantage, strong enough to influence the whole policy of the company, and presented in such a way and to such officials as to effect the change. This advantage may be one of price or of quality, or based on patents, or may be indirectly acquired as part or consequence of other business dealings not related to the sale itself, but it must certainly and decidedly exist. It is for the manufacturer himself to decide whether or not he possesses or can acquire this advantage."

Lists of electric light and power and electric railway systems in the various countries of South America are given together with general information. Some of this information follows:

Argentina.—There are now about 132 electric power stations. In view of the rapidly increasing demand for power and the high cost of coal there seems to be no doubt that future production of electric power will be through fuel oil. There is and will be plenty of opportunity for the investment of American capital in street railway and electric light and power construction enterprises under favorable conditions.

Bolivia.—There are only three or four towns of any importance and population, and the present field for street railroad and power transmission material is restricted. On account of the presence of good water power possibilities, however, and the difficulty of importing coal, with its attendant high cost, this country, as its development progresses, should be an excellent market for American material used in generating and transmitting hydro-electric power.

Brazil.—Coal is found in southern Brazil, and the war has stimulated its mining in commercial quantities, but not to the extent of meeting even one-fifth of the normal coal requirements of the nation. Coal was formerly supplied by Great Britain, but is now largely imported from the United States. The price of coal has risen from about $9 a ton, before the war, to more than $30 a ton in 1918. Under these circumstances it is only natural that the water power which nature so abundantly provided should be extensively utilized. It is believed that most of the electric power generated within the Republic is produced in this way, and it is quite certain that practically all of the developments of the future will be hydro-electric.

Chile.—Coal is very expensive in Chile, and a great incentive exists to the development of hydro-electric power, which, potentially, exists so plentifully in the South. The Chilean government which has always been characterized by a progressive and liberal spirit, appreciates the situation and is itself among the foremost to put theory into practice and encourage others to do the same. The government has created a commission to study the possibilities of constructing a longitudinal artery for the transmission of electric power through the section from Coquimbo to Valdivia, which, if carried out, will make available for commercial purposes a large amount of cheap power, developed from the numerous streams crossing this region.

Colombia.—Water power is abundant, and the development of electrical energy through this means is bound to be a considerable factor in the future when the population and industries of the country warrant. There are only five electric light and power plants in the country, and electricity is not used in mining, railways, or agriculture.

Ecuador.—Notwithstanding the sparsity of the population, electricity for lighting and power purposes is more extensively used than might be expected. The prevalence of medium-head waterfalls throughout the interior of the country makes the installation of small hydro-electric plants quite feasible, and it is said that no towns are without electric lights that would require the output of a generator larger than thirty kw. However, there are only four plants of a capacity of more than two hundred kw.

The Guianas.—Water power is plentiful but unutilized. Coal is not found, but the presence of oil is indicated, which may have an important influence in the future. Under the circumstances the use of electricity is not extensive, but increased power demands are expected to follow industrial growth. It should be remembered, however, that these are colonies of European guide the purchase of electrical material to the markets powers, and consequently every effort will be made to of the home land.

Paraguay. — The population is scattered in the rural districts and does not require the extensive use of electricity. Consequently we find very little electrical development, and no very promising immediate future. Hydro-electric plants are quite feasible along the principal rivers, but the greatest possibility along these lines lies in the Falls of Iguazu, which are not in Paraguay but on the boundary between Agentina and Brazil. They are only a few miles from the Paraguayan boundary and their development will be of more value to Paraguay than to either of the other countries.

Peru.—Coal is found in considerable quantities and water power is plentiful, so that the development of electrical enterprises is certain to keep pace with other industries and the growth of population, though at present it cannot be said to be extensive. Unfortunately, the costal regions, where progress is most rapid, are poorly supplied with water power. . . . However, hydro-electric developments of small size are possible, and irrigation projects, which are constantly being proposed, will eventually be carried out and provide additional water power. The general trend of conditions seems to be toward an era of constructive development in which the production and use of electricity will have an important part. American goods are well known and liked in Peru, and the influence of American investments, especially in the mining industries, is quite strong.

Uruguay.—The electric exploitation is monopolized by the Government. In 1912 an act was passed authorizing the Government to erect sixteen State power houses at La Paz, Las Piedras, Pardo, Punta del Este, Maldonado, San Carlos, Santa Lucia, Canelones, Rosario, Dolores, Nico Perez, Sarandi del Yi, Treinta y Tres, San Fructuoso, and San Eugenio. The initial amount to be spent in each place was $25,000. Twelve existing concessions were to be bought out at an estimated cost of $1,200,000 and a sum of $3,300,000 was to be available for extending and establishing new plants. It is not known to what extent the war has interfered with this plan.

Venezuela.—Water power is plentiful, owing to the mountainous nature of the country and the numerous streams, many of which are of considerable size. Coal of very excellent quality is found in five different sections of the country. Petroleum has also been found. At the present time public service utilities are confined to a few of the larger towns. Doubtless many enterprises generate their own power from local streams or coal deposits, and certainly electrical power will play an important part in future development.

SWEDISH DEVELOPMENTS

In the pamphlet concerning Sweden the amount of water power normally available is set at 5,000,000 hp. Railroad electrification and provision for electrical energy for industry and agriculture are projected on a large scale. Recently a combination of thirty-three of the largest power producers of Central Sweden, the Aktiebolaget Bergalagens Combinee Power Control, has been formed. The purpose is said to be fuller utilization of existing generating capacity.

Current Distribution in Armature Conductors

Equations Are Derived Showing How Alternating Current Resistance Depends Upon Depth of Slot—Calculations of Deep-Slot Induction Motors with High Torque May Thus Be Investigated—Condensed Formulas Proposed by Dr. Kennelly

BY WALDO V. LYON
Assistant Professor of Electrical Engineering, Massachusetts Institute of Technology

A MATHEMATICAL investigation of current distribution in armature conductors in open slots reveals the fact that, beyond a certain depth, the alternating-current resistance varies directly as the slot depth. The relations thus derived have an important application in the design calculations of high-torque induction motors such as those used for the propulsion of the new battleships of the United States Navy. It is also shown that the assumption of uniform current distribution, in the calculation of leakage reactance, leads to serious errors, especially in the case of deep slots. In order to reduce the problem of alternating-current distribution in armature conductors to its simplest and most workable form, it is assumed that the conductors are of rectangular cross-section and are embedded in slots which have parallel sides and are not wholly closed. Fig. 2 is a cross-section showing a typical arrangement of this sort. When this conductor carries current there is established about it a magnetic field as indicated by the flux lines *a*, *b* and *c*. Elements of the conductor near the bottom link more flux than those near the top and will therefore have a greater inductance. The true resistance of all elements is of course the same. Since the voltage drop through a given length of each element is the same, it follows that the current density will be least at the bottom and greatest at the top of the conductor when the current is an alternating one. This phenomenon is very frequently described as "skin effect." In calculating the distribution of current it will be assumed, as is usually done, that the reluctance of the iron portion of the magnetic circuit is negligible compared with the reluctance of the space within the slot. This is, of course, equivalent to neglecting the eddy currents and hysteresis due to this so-called leakage flux, although they often account for an important loss in the machine.

The flux is assumed to cross the slot in parallel lines. Whenever this assumption is permissible, the current densities in elements cut by the same flux line are equal, no matter what the shape of the cross-section of the conductor may be. Furthermore, the relative current densities at points within the conductor below any flux line are not affected by flux that may exist above this line. That is to say, the conductor may be divided longitudinally by a surface in which the flux density is constant and the upper portion of the conductor removed without affecting the relative current densities in the lower portion of the conductor. For example, referring to Fig. 2, the current densities at the points *u*, *y* and *z* on the flux line *b* are equal. Also the portion of the conductor above this flux line may be removed without changing the relative current densities at any points in the lower or cross-hatched section of the conductor. The only flux that modifies the current within a given cross-section of a conductor is that within the cross-section. If there are two conductors in a slot, one above the other, the upper conductor has no appreciable effect in modifying the distribution of current within the lower conductor, although the current in the lower conductor influences the current distribution in the upper one. These statements are true no matter what the shape of the cross-section may be. They depend only upon the assumption that the flux lines through the conductor are parallel, as they are nearly, if the slot is not wholly closed.

The fundamental equation used in determining the current density is

$$e = \rho c + d\phi/dt + d\Phi/dt \text{ c.g.s. electromagnetic units} \quad (1)$$

e is the voltage between cross-sections of the conductor 1 cm. apart; c is the current density at any point in the conductor; ρ is the resistivity of the conductor; ϕ is flux within the conductor linking the element of current considered; Φ is flux outside the conductor. The flux within the conductor linking a given element of current is equal to

$$\phi = \int_x^d \frac{4\pi}{s} i_x dx \qquad c.\ g.\ s.\ lines$$

in which i_x is the current in the conductor below the element considered, and s is the width of the slot. If this value for ϕ is substituted in equation (1) and the equation is differentiated twice with respect to x, it becomes

$$0 = \rho \frac{\delta^2 c}{\delta x^2} - \frac{4\pi w}{s} \frac{\delta c}{\delta t} \qquad c.\ g.\ s. \qquad (2)$$

Differential equations of this same form are used in solving other important physical problems; for example, the flow of heat, the distribution of magnetic flux in laminations,[1] and the distribution of electric current in very wide conductors of rectangular cross-section[2].

If the current varies sinusoidally with the time, the general solution for the current density is

$$\begin{aligned} c = {} & K_1 \varepsilon^{mx} (\cos mx \sin(\omega t + \alpha) \\ & + \sin mx \cos(\omega t + \alpha)) \\ & + K_2 \varepsilon^{-mx} (\cos mx \sin(\omega t + \alpha_2) \\ & - \sin mx \cos(\omega t + \alpha_2)) \end{aligned} \qquad (3)$$

The constants of integration are K_1, K_2, α_1 and α_2. $m = 2\pi \sqrt{\frac{fw}{s\rho}}$. In this particular case the solution can be written in a much simpler form, since $K_1 = K_2$ and $\alpha_1 = \alpha_2$ so that the equation becomes, expressed in practical units;

$$\begin{aligned} c = {} & K(\cosh mx \cos mx \sin \omega t \\ & + \sinh mx \sin mx \cos \omega t) \text{ amp./cm.} \end{aligned} \qquad (4)$$

Since $i = \int^d wcdx$, the constant of integration is

$$K = \frac{2\sqrt{2}\, I}{w \sqrt{\cosh 2md - \cos 2md}} \text{ amp/cm}^2$$

[1] See Alexander Russell, "Alternating Currents," Vol. 1, page 353.
[2] See A. E. Kennelly and H. A. Affel, "Skin-Effect Resistance Measurement of Conductors," *Proceedings Institute of Radio Engineers*, May, 1916; Appendix III.

I is the current in amperes in the entire conductor, and w is the width of the conductor. The instantaneous value of the current in the conductor is found by integrating the current density from zero to d. When written in complex notation it is

$$I = \frac{w K}{2 m}\left[\begin{matrix}(\cosh mx \sin mx + \sinh mx \cos mx) \\ +j\,(\cosh mx \sin mx - \sinh mx \cos mx)\end{matrix}\right] \text{amp.} \quad (5)$$

The instantaneous voltage drop per centimeter in the

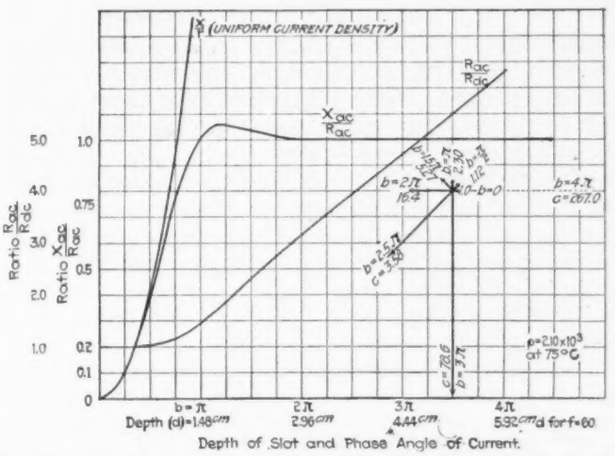


FIG. 1—VARIATION OF ALTERNATING-CURRENT RESISTANCE WITH SLOT DEPTH AND EFFECT OF ASSUMPTION THAT CURRENT DENSITY IS UNIFORM

conductor due to its resistance and to the flux within the conductor equals the product of the specific resistance and the current density in the uppermost layer. This voltage, when written in complex notation, is

$$V = \rho K\,[\cosh md \cos md + j \sinh md \sin md] \text{ volts} \quad (6)$$

The leakage impedance in complex form is

$$Z = \frac{b\,\rho}{2a}\left[\frac{\sinh b + \sin b}{\cosh b - \cos b} + j\,\frac{\sinh b - \sin b}{\cosh b - \cos b}\right] \text{ohms} \quad (7)$$

$$b = 4\,\pi\,d\sqrt{\frac{f\,w}{s\,\rho}} \text{ radians,}$$

in which b is the phase angle of the current and $a = wd$ = cross-section area, sq.cm.

The resistance of such a conductor to alternating current is thus

$$R_{ac} = \frac{b\,\rho}{2a}\,\frac{\sinh b + \sin b}{\cosh b - \cos b} \text{ ohms.}$$

The resistance to direct current is $R_{dc} = \frac{\rho}{a}$ ohms

The ratio of alternating to direct current resistance is therefore

$$\frac{R_{ac}}{R_{dc}} = \frac{b}{2}\,\frac{\sinh b + \sin b}{\cosh b - \cos b} \quad (8)$$

The ratio of leakage reactance due to flux within the conductor to the alternating resistance is

$$\frac{X}{R_{ac}} = \frac{\sinh b - \sin b}{\sinh b + \sin b} \quad (9)$$

Ordinarily the reactance of such a conductor is calculated on the assumption that the current density is uniform. In this case the ratio of reactance to resistance is $\frac{x}{r} = \frac{b^2}{6}$.

Fig. 1 shows the manner in which the current density and the resistance and reactance vary in such a conductor. These curves are plotted for the case in which the conductor completely fills the slot. w is then equal to s, and the angle b which appears in the various formulas equals 4π times the depth of the conductor in centimeters times the square root of the frequency in cycles per second divided by the specific resistance in c.g.s. units; *i.e.*, the specific resistance in ohms per centimeter cube multiplied by 10^9. As shown by the scales of abscissas, the angle b equals π when the depth of the conductor is 1.48 centimeters for a frequency of 60 cycles and a specific resistance of 2.10 microhms per centimeter cube. This angle b determines the manner in which the current density, the ratio of alternating current to direct current resistance and the ratio of reactance to resistance vary. If, for example, the current density at the bottom of such a conductor is taken as unity, at a point above this corresponding to an angle of π the current density will be 2.3 times as great and will lead by an angle of 90 deg. At double this distance from the bottom the current density is 16.4 times as great and is in exact opposition. That is to say, the current will be flowing in opposite directions in the conductor at the same moment at these two points.

If the conductor is of a depth corresponding to an angle $b = 4\pi$, the current density in the upper layer will be 267 times as great as the current density in the bottom layer and will be in time phase with it. This fact, that the current may be flowing in opposite directions at different points in a conductor at the same time, has long been known. It is interesting to note that the locus of the vector representing the current density is practically a logarithmic spiral for angles, b, greater than 3π.

DEPENDENCE OF ALTERNATING-CURRENT RESISTANCE ON SLOT DEPTH

The ratio of alternating to direct resistance is practically unity for conductors less than 0.75 cm. deep at a frequency of 60 cycles. For conductors deeper than about 1.5 cm. the ratio of alternating to direct resistance

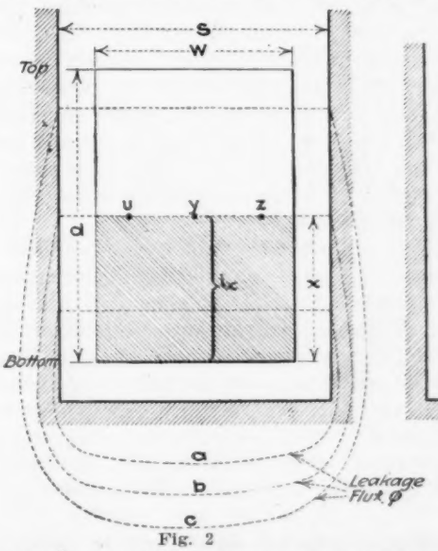


Fig. 2

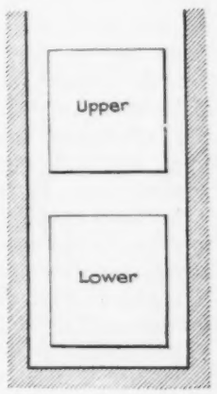


Fig. 3

FIG. 2—FLUX IS ASSUMED TO CROSS SLOT IN PARALLEL LINES.
FIG. 3—COMMON ARRANGEMENT OF CONDUCTORS IN A SLOT

is practically proportional to the depth of the conductor. The ratio of reactance to resistance is interesting. It reaches a maximum value of about 106 per cent for a conductor of 1.70 cm. deep at a frequency of 60 cycles and a resistivity of 2.1 microhms per centimeter cube, but if the conductor is more than 3 cm. deep under these

conditions the reactance and resistance are equal. The ratio of reactance to resistance on the assumption of uniform current density is correct only for very shallow conductors. If the depth of the conductor is such that the angle b is not more than $\pi/2$, the current is practically uniformly distributed over the cross-section of the conductor, the alternating and direct current resistances are equal, and the reactance may be calculated in the usual way. b varies directly with the depth of the conductor, directly as the square root of the frequency, and inversely as the square root of the resistivity. Thus at 25 cycles rather than at 60 the conductor would need to be 55 per cent deeper in order that the skin effect should be the same. A conductor of high resistance material would likewise need to be much deeper in order that the skin effect should be the same. Thus one which had a resistivity sixteen times that of copper would need to be four times as deep to have the same skin effect.

The fact that the skin effect varies in the manner shown with the depth of the conductor and the frequency is quite important in the design of squirrel-cage induction motors and the damper windings of synchronous machines. With an induction machine a high efficiency necessitates a low rotor resistance, whereas if the starting torque is to be large, the rotor resistance must be high. Since under running conditions the frequency of the rotor currents is very low, the skin effect is negligible, while at starting, when the rotor current is of the rated frequency, the skin effect may be quite considerable, especially if the rotor conductors are deep. If, for example, rotor conductors 2 cm. by 2 cm. in cross-section are replaced by others that are 1 cm. by 4 cm; the starting torque is more than twice as great for the same current, although the efficiency is not changed. The deeper conductors, however, would probably require a rotor of larger diameter in order that the rotor core may have the proper cross-section back of the teeth. In order that a damper winding may be efficient in limiting hunting in a synchronous machine, its resistance must be low. The frequency of the current set up in the damper due to hunting, however, is so small that the skin effect is negligible. If the damper is used to increase the starting torque, it is more effective if its conductors are as deep as practicable. Again in the latter case, the field poles would need to be somewhat longer in order to accommodate the same field winding back of the damper.

Another problem, although one much more difficult to solve, is the case of two rectangular conductors, one above the other in the same slot, as shown in Fig. 3. The distribution of current in the lower conductor is independent of the current in the upper one, but the equation for the current density in the upper conductor must now be written in its general form (see equation 3). The introduction of four constants of integration makes the computations much more difficult—so much more so, in fact, that they will not be attempted here.

[Dr. A. E. Kennelly, who has done much to develop the application of hyperbolic functions of complex angles to the solution of such problems, adds the following discussion.—EDITOR.]

APPLICATION OF HYPERBOLIC FUNCTIONS OF COMPLEX ANGLES

In the foregoing discussion the author made use of complex numbers, but has not used complex angles. If one avails himself of complex angles the formulas can be shortened and condensed as follows:

Starting with the differential equation (2), its solution may be written in the form

$$\frac{c_x}{c_d} = \frac{\cosh \alpha x}{\cosh \alpha d} \text{ numeric } \angle$$

where $\alpha = \sqrt{j\,4\pi\left(y\frac{w}{s}\right)\mu\omega} = \sqrt{j\,2\,m^2} = m + j\,m = m\,\sqrt{2}\,\angle\,45°$, y being the actual conductivity of the copper and $(w/s)y$ the effective conductivity in view of the insulating wall between the copper and the magnetic polar surfaces of the slot. The angular velocity $\omega = 2\pi f$ radians per second. The hyperbolic angles αx and αd are both semi-imaginary.

The average current density over the whole cross section of the bar is

$$c_q = \frac{I}{wd} = \frac{1}{d}\int_o^d c_x\,dx = \frac{1}{d}\frac{c_d}{\cosh \alpha d}\int_o^d \cosh \alpha x\,dx =$$

$$\frac{1}{\alpha d}\frac{c_d}{\cosh \alpha d}\sinh \alpha d = c_d\frac{\tanh \alpha d}{\alpha d}, \frac{amp.}{cm^2} \text{ amp. per sq. cm.}$$

The skin effect impedance ratio Z/R_{dc} is:

$$\frac{Z}{R_{dc}} = \frac{c_d}{c_q} = \frac{\alpha d}{\tanh \alpha d} = \frac{dm\sqrt{2}\,\angle 45°}{\tanh\,(dm\sqrt{2}\,\angle 45°)} \text{ numeric } \angle$$

The real part of this ratio is R_{ac}/R_{dc}, the skin effect resistance ratio.

For any given value of $dm\sqrt{2}$, tanh $(dm\sqrt{2}\angle 45°)$ can be found from published charts and tables. When dm exceeds 4, tanh $(dm\sqrt{2}\angle 45°)$ is practically unity, so that then

$$Z/R_{dc} = dm\ \sqrt{2}\angle 45° = \alpha d \text{ numeric } \angle$$
$$\text{and } R_{ac}/R_{dc} = dm \text{ numeric } \angle$$

The equivalent skin depth of alternating-current penetration is then also $1/m$ *cm*.

From the standpoint of skin-effect theory the case considered in this article of a rectangular copper bar mounted at the base of a rectangular slot in laminated steel is of particular interest, because it presents a case of a copper strip devoid of edge effect and subject only to skin effect on one face. Rayleigh[3] first published in 1886, the formula for the skin effect in an indefinitely wide conductive strip, and therefore for a strip of copper devoid of edge effect because the magnetic flux paths are all parallel to the strip surfaces. It has only been found possible to realize such a condition by placing two such similar strips A and B parallel, A say immediately over B, the two being separated by a thin uniform layer of insulator, and making A the going and B the returning conductor; so that the flux in the insulating layer between them will be sensibly parallel to the strip surfaces except near the edges. Such pairs of strips have been tested and found to have very small edge effect.[4] A single flat strip has been found, however, to have a greatly increased effective resistance, owing to edge effect, since the magnetic flux intersects the strip at all parts except at the center of its width.[5]

In the dynamo armature bar conductor here considered, however, neglecting magnetic lag and losses in the iron, the bar is subject to the pure skin effect of an infinitely wide strip even in very narrow specimens, owing to the parallelism of the flux to the bar's surface.

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[3] Rayleigh, *Phil. Mag.*, 1886; *Scientific Papers*, Vol. 2, pp. 486-495.

[4] Kennelly, Laws and Pierce, "Experimental Researches on Skin Effect in Conductors," *Proceedings A. I. E. E.*, September, 1915.

Standardized Industrial Lighting Systems

Engineering Plans for Conduit, Wiring, Panel and Fixture Arrangements Which Strictly Follow the Code and at the Same Time Utilize All the Material to the Fullest Extent

BY H. L. CORNELISON
Electric Equipment Engineer, the Austin Company, Cleveland, Ohio

FOR the standard types of buildings which it constructs the Austin Company has designed standard electric lighting installation. Throughout all of the electrical designs it has been the aim to provide an installation that is in every way adequate and that is at the same time economical to construct when considered from the standpoint of both material and labor. So successful have been the efforts of the engineers in the economical use of material that every fitting and every piece of conduit carries the maximum number of circuits considered allowable by the National Electrical Code. While the designs were intended primarily for the particular types of buildings made by the Austin Company, they are capable of being applied to many other new and existing buildings because of the general similarity of the modern industrial structures. For this reason engineering data concerning the more representative types of construction are given in considerable detail on the drawings which accompany this article. Considerations which have influenced engineering, choice of materials and layouts are given in the text of the article.

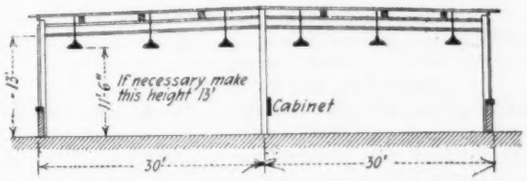


FIG. 1. CROSS-SECTION OF STANDARD BUILDING I (SEE FIG. 4)

It should be realized, of course, that these systems of lighting cannot be applied blindly. They were designed to fit buildings in which all dimensions, the locations of all columns and all other factors that are usually variable were standard. However, by using some judgment in connection with the layouts it should be possible for engineers who handle illumination to take advantage of the results which are shown on the plans. In making such use of the information the first step is to determine what intensity should be used. This can be found by reference to the appendix of almost any of the modern lighting codes, where industries are classified as to the lighting they need. With this known, reference should be made to the layouts published with this article. There the cross-sections of several building types are shown. From these a selection can be made that will be nearly like the one to be lighted. Then, under the sketches of the plans of buildings, are given the number of outlets per bay required to produce the desired intensity. If more than one layout could be selected to fulfill the requirements, it is a matter of judgment in balancing the better distribution to be obtained by using a greater number of outlets per bay against the lesser cost of installing the job with fewer outlets and the same intensity.

For example, suppose it is desired to light a paint shop where ordinary hand painting is being done. Assume also that the building can be divided into 20-ft. by 30-ft. (6-m. by 9-m.) bays. By reference to the appendix to the Ohio Lighting Code it will be seen that the intensity recommended for paint shops of this class is 6 foot-candles. By reference to the drawings herewith it will also be found that building No. 1 has bays 2 ft. by 30 ft. By looking under sketches Ic and Id it will be seen that either of these layouts will give the required illumination but that sketch Id will produce lighting distribution which is better because it has six outlets per bay while sketch Ic has only four outlets per bay. Obviously the installation with the greater number of outlets will cost more. It is then a case of making a decision as to whether the better distribution of light is worth the additional money. In connection with this sort of use the sketches should prove particularly valuable because they show all of the accepted methods of obtaining given intensities.

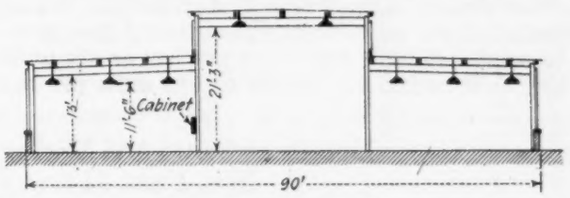


FIG. 2. CROSS-SECTION OF STANDARD BUILDING II (SEE FIG 5)

Perhaps a better understanding and a fuller appreciation of the engineering data on these layouts can be given by recounting the story of their preparation. The engineers who prepared them first made a decision as to the intensities that should be employed and as to their range. They decided that intensities of 2 foot-candles, 4 foot-candles, 6 foot-candles would give a good range and would afford better lighting in all ordinary cases than industrial buildings have at present. At that time no specific results of lighting under productive intensities were available so those intensities higher than 8 foot-candles were not considered. Moreover, there were some commercial considerations which had to be taken into account. Next, a decision had to be made as to how many outlets per bay it would be advisable

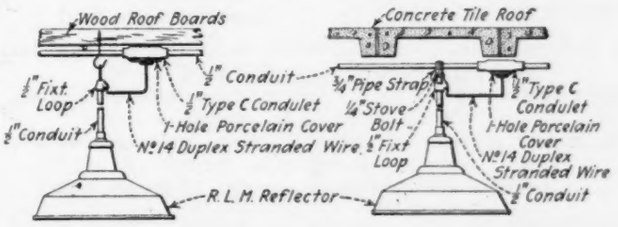


FIG. 3. STANDARD METHOD OF HANGING LAMP AND REFLECTOR UNITS ON WOOD ROOFS AND CONCRETE ROOFS

to recommend for giving these intensities. To do this the engineer started out by tabulating, putting down the figures 2, 4, 6 and 8 in a vertical column to represent the intensity and setting down numbers of outlets opposite each intensity in a horizontal column. The figure 5 was omitted from each of these columns of outlets since it was particularly desired to keep away from this sort of lighting arrangement. Considering first the buildings which have bays 20 ft. by 30 ft. (6 by 9 m.), it was determined that for intensities of 2 foot-candles an arrangement of one unit per bay or of two units per bay would be the only one which would give a practical arrangement. Likewise, for intensities of 4 foot-candles it was decided that two units, four units or six units would give the required intensity and provide the proper variety of choices in the matter of distribution. Where 6 foot-candles was required it was obviously poor practice to use fewer than four units per bay or six units per bay, so arrangements of one or two units per bay were eliminated. In this manner the table which is published herewith under the heading "General Unit Sheet" was worked out. As will be seen from this table, this building covers ten types of standard buildings which have bays 20 ft. by 30 ft., 20 ft. by 40 ft. and 20 ft. by 50 ft. (6 m. by 9 m., 12 m. and 15 m.) under different conditions and which have both high and low roofs.

The mounting height was next considered, and it was decided that for high bays the reflectors should be mounted on the line with the truss in all buildings, but that in low bays it would be advisable to consider a mounting height of all reflectors as 11.5 ft. (3.5 m.) above the floor. The mounting height of the reflectors in the high bays was chosen so that the reflectors and units would be out of the way of any cranes that might be operated in the building. The mounting height of reflectors in low bays was determined from past experience as the best height adaptable for the higher-intensity system. At the mounting height recommended

Details of Lamp and Wiring Layouts in Standard Building Nos. I and II (see Figs. 1, 2 and 4 and 5)

BUILDING Ia—(Four Outlets per Circuit, One per Bay)

2 ft.-candles; one 200-watt lamp.
Main feed for sixteen bays, 60-amp., three-pole-switch, three No. 6 wires, 1¼-in. conduit.
Main feed for twenty-four bays, 60-amp., three-pole-switch, three No. 2 wires, 1½-in. conduit.

BUILDING Ib—(Four Outlets per Circuit, Two per Bay)

2 ft.-candles; two 100-watt lamps; 4 ft.-candles; two 200-watt lamps.
Main feed for sixteen bays, 60-amp., three-pole switch, three No. 4 wires, 1¼-in. conduit.
Main feed for twenty-four bays, 100-amp., three-pole switch, three No. 2 wires, 1½-in. conduit.

BUILDING Ic—(Six Outlets per Circuit, Four per Bay)

4 ft.-candles; four 100-watt lamps; 6 ft.-candles; four 150-watt lamps; 8 ft.-candles; four 200-watt lamps.
Main feed for twelve bays, 100-amp., three-pole switch, three No. 4 wires, 1¼-in. conduit.
Main feed for eighteen bays, 200-amp., three-pole switch, three 1/0 wires, 2-in. conduit.
Note—With 200-watt lamps use No. 12 duplex wire.

BUILDING Id—(Six Outlets per Circuit, Six per Bay)

4 ft.-candles, six 75-watt lamps; 6 ft.-candles, six 100-watt lamps; 8 ft.-candles, six 150-watt lamps.
Main feed for twelve bays, 100-amp., three-pole-switch, three No. 2 wires, 1½-in. conduit.
Main feed for eighteen bays, 200-amp., three-pole switch, three 3/0 wires, 2½-in. conduit.
Note—With 150-watt lamps use No. 12 duplex wire.

BUILDING IIa—(Four Outlets per Circuit)

Outside bays, one outlet per bay.
2 ft.-candles, one 200-watt lamp; 4 ft.-candles, one 400-watt lamp.
Center bay, one outlet per bay.
2 ft.-candles, one 200-watt lamp; 4 ft.-candles, one 400-watt lamp.
For eight-circuit cabinets.
Feed for sixteen bays, 60-amp., three-pole switch, three No. 6 wires, 1¼-in. conduit.
Feed for twenty-four bays, 100-amp., three-pole switch, three No. 2 wires, 1½-in. conduit.
Note—If 400-watt outlets are required place two outlets per circuit instead of four and use conduit of size indicated for dotted layout.
Two outlets per circuit, 16-circuit cabinets.
Main feed for sixteen bays, 100-amp., three-pole switch, three 1/0 wires, 2-in. conduit.
Main feed for twenty-four bays, 200-amp., three-pole switch, three 2/0 wires, 2-in. conduit.

BUILDING IIb—(Four Outlets per Circuit)

Outside bays, two outlets per bay.
2 ft.-candles, two 100-watt lamps; 4 ft.-candles, two 200-watt lamps.
Center bay, two outlets per bay.
2 ft.-candles, two 150-watt lamps; 4 ft.-candles, two 200-watt lamps.
Note—Main feed for sixteen bays, 100-amp., three-pole switch, three 1/0 wires, 2-in. conduit; main feed for twenty-four bays, 200-amp., three-pole switch, three 2/0 wires, 2-in. conduit.

BUILDING IIc

Outside bays, four outlets per bay.
4 ft.-candles, four 100-watt lamps; 6 ft.-candles, four 150-watt lamps; 8 ft.-candles, four 200-watt lamps.
Center bays, two outlets per bay.
2 ft.-candles, two 150-watt lamps; 4 ft.-candles, two 200-watt lamps; 6 ft.-candles, two 300-watt lamps; 8 ft.-candles, two 400-watt lamps.
Note—Six outlets per circuit in low bays; three outlets per circuit in high bays.
Use No. 12 duplex instead of No. 14 wire if 200, 300 or 400-watt outlets are used.
Note—Main feed for twelve bays, 100-amp., three-pole switch, three No. 2 wires, 1½-in. conduit; main feed for eighteen bays, 200-amp., three-pole switch, three 3/0 wires, 2½-in. conduit.

BUILDING IId

Outside bays, six outlets per bay.
4 ft.-candles, six 75-watt lamps; 6 ft.-candles, six 100-watt lamps; 8 ft.-candles, six 150-watt lamps.
Center bay, two outlets per bay.
2 ft.-candles, two 150-watt lamps; 4 ft.-candles, two 200-watt lamps; 6 ft.-candles, two 300-watt lamps; 8 ft.-candles, two 400-watt lamps.
Note—Six outlets per circuit for low bays; three outlets per circuit for high bays. If 300- and 400-watt outlets are used, run No. 12 duplex wire instead of No. 14 wire in center bay.
Main feed for 12 bays, 200-amp., three-pole switch, three 1/0 wires, 2-in. conduit.
Main feed for twelve bays, 200-amp., three-pole switch, three 3/0 wires, 2½-in. conduit.

no objectionable shadows will be cast by line shafting, pulleys or belting.

The engineers then collected the information that gas-filled tungsten lamps are manufactured in the following sizes: 75-watt, 100-watt, 150-watt, 200-watt, 300-watt, 400-watt, 500-watt, 750-watt and 1000-watt. In some instances the lamps used for the calculations which

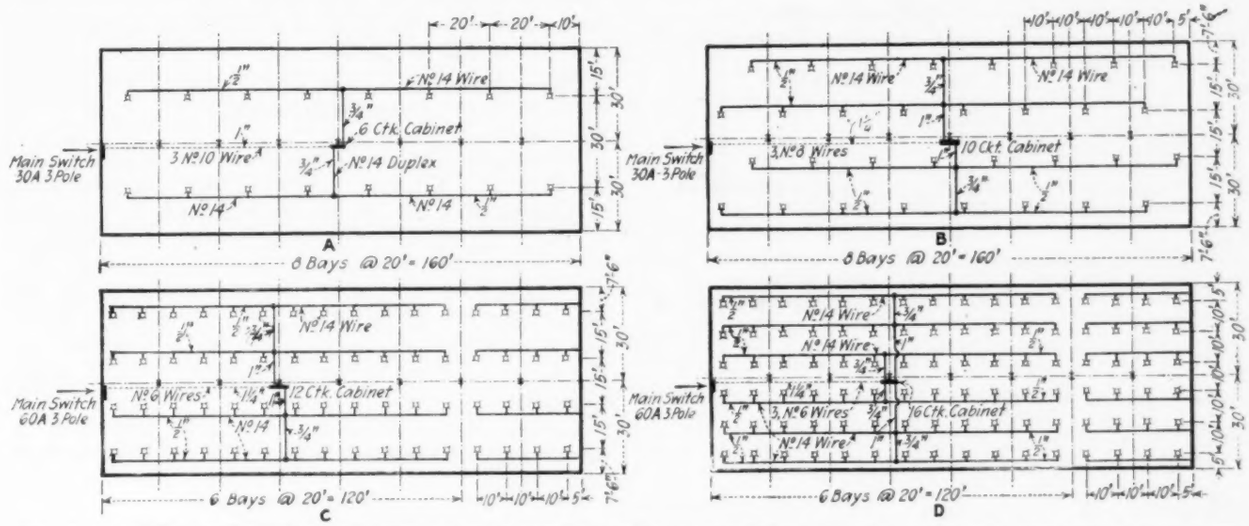


FIG. 4. LAYOUT OF LIGHTING FIXTURES IN FLAT-ROOFED, LOW-BAY BUILDING (CALLED STANDARD BUILDING I) TO GIVE INTENSITIES RANGING FROM 2 FOOT-CANDLES TO 8 FOOT-CANDLES

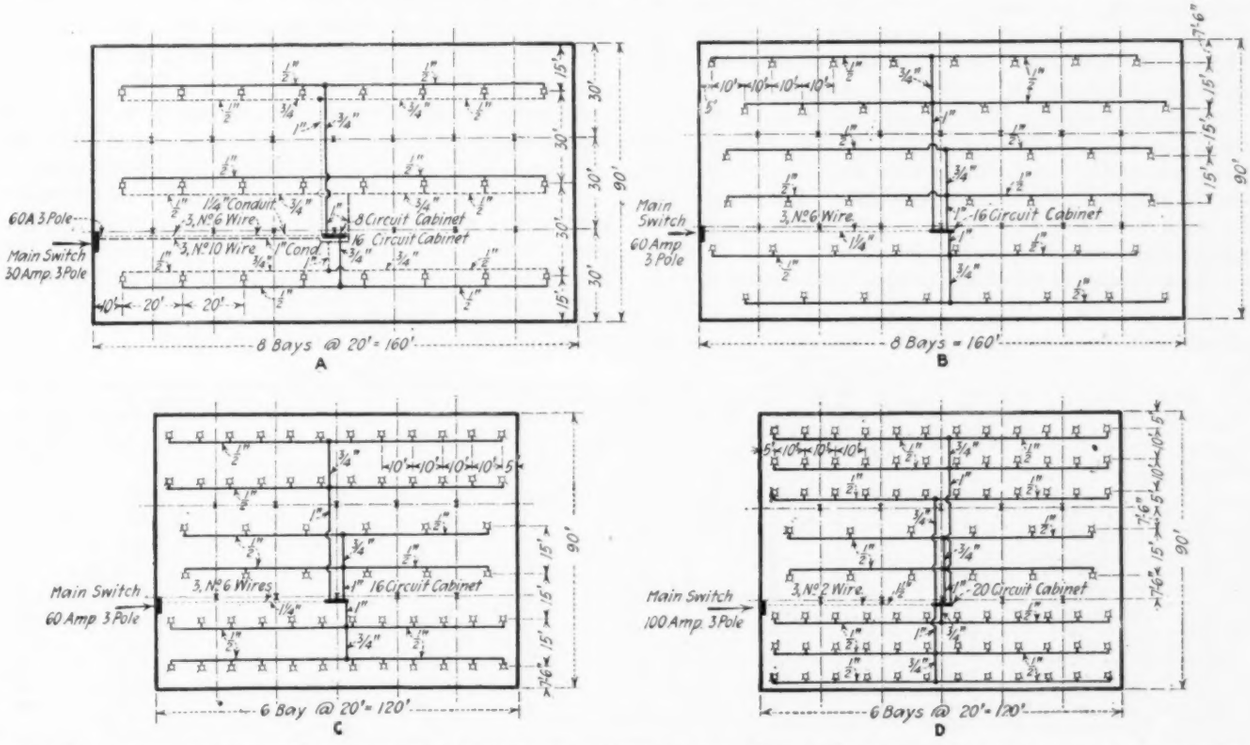


FIG. 5. LAYOUT OF FIXTURES IN BUILDING (STANDARD BUILDING II WITH BOTH HIGH AND LOW BAYS) TO GIVE INTENSITIES RANGING FROM 2 FOOT-CANDLES TO 8 FOOT-CANDLES AND WITH DIFFERENT MOUNTING HEIGHTS

were to follow did not give the exact intensities desired, but nevertheless their sizes may be considered as correct and they may be used, for they come fairly close to giving the proper intensity. The calculations also brought out the fact that the 250-watt lamp particularly would be economical in many places.

The R. L. M. standard reflector was specified throughout because it was considered the most suitable design available at present and because it is the result of the coöperative work of all lamp and reflector engineers. All calculations were based on the use of the R. L. M. reflector and the installation of gas-filled tungsten lamps. In connection with the R. L. M. reflector the adoption of bowl-frosted lamps can be considered in these designs with all the low mounted units in order to reduce the brilliancy of the light source. However, a sacrifice of about 3 per cent in intensity must be made. If an opal cap be used in connection with the clear non-frosted bowl lamps, a better distribution of light may be obtained. However, an additional sacrifice of 2 per cent to 3 per cent in intensity must be made over that considered with the frosted-bowl lamps.

With these decisions made the engineers took actual

plans of the building layouts and on about four bays of each type of building laid out the units and calculated by the lumen method the size of lamps that would be required, using the formula

Lumens = (area (sq. ft.) × foot-candles) ÷ 0.45.

In this formula the area refers to the total area of space lighted, "foot-candles" refers to the intensity of illumination required, and the value 0.45 represents the coefficient of utilization and covers loss of light due to the depreciation of the lamps, to the collection of dust and dirt on the lamps and reflectors and to absorption by reflectors, columns, walls, line shafting and belting.

GENERAL UNIT SHEET—LOW BAYS

Foot-Candles	Required Units	Remarks
2	1-2	For buildings Nos. 1, 2, 4, 5, 6 and 7
4	2-4-6	Bays 20 ft. by 30 ft.
6	4-6	
8	4-6	
2	2-3-4	For buildings Nos. 3 and 10 (see next installment)
4	3-4-6	Bays 20 ft. by 50 ft.
6	3-4-6-8	
8	6-8	

GENERAL UNIT SHEET—HIGH BAYS

2	1-2	For buildings Nos. 3, 6 and 10 (see next installment)
4	2-3	Bays 20 ft. by 50 ft.
6	2-3	For building No. 5
8	2-3	Bays 20 ft. by 40 ft.
2	1-2	For buildings Nos. 2 and 4
4	1-2	Bays 20 ft. by 30 ft.
2	2	For building No. 7
4	2-3	Bays 20 ft. by 60 ft.
6	2-3	
8	2-3	

After the insertion of the numerical value in this formula the result will be the total lumens necessary to light the entire area. This value divided by the number of lamps will give the number of lamps required for each unit, and this value in turn shows the size of lamps to be used.

These data were tabulated as they were obtained, making a survey of necessary lamp sizes for all types of buildings. When this survey had been completed the entire table of data was checked by the point-by-point method of caculation. This showed accurately what sizes of lamps should be used and gave accurate wattage information on which calculation for proper wire sizes, conduit sizes and panelboard requirements could be made. As has been stated earlier in the article, these calculations were made carefully so that each conduit fitting was worked to its full rating under the National Electrical Code.

For example, by referring to the plan one will note that where inch conduit is specified four circuits are contained therein, which is the maximum number permitted by the National Code. Another feature which is a labor-saving expedient is the use of a one port entry fixture hanger, using duplex wire, which may be hung either on a screw hook, or by means of pipe strap and stove bolt attached to the conduit run, permitting of approximately 1 ft. (0.3 m.) adjustment either side of the outlet, and at the same time giving a flexible joint for the fixture.

In presenting this information to the electrical industry the Austin Company wishes to take this opportunity to acknowledge the assistance rendered in this work by H. T. Spaulding of the engineering department of the National Lamp Works of the General Electric Company, Nela Park, Cleveland; Otis L. Johnson of the Benjamin Electric & Manufacturing Company, Chicago, and A. H. Sullivan, electrical engineer, formerly employed in the engineering department of the Austin Company.

Cross-sections and layouts of lighting fixtures in two other types of buildings will be discussed in a subsequent issue.

INCREASE OF MAINE WATER POWERS THROUGH REGULATION

By Construction of Storage Reservoirs the Twenty-four-Hour Service for 60 per Cent of Year Will Be Increased 12 per Cent

The Maine Public Utilities Commission, in its recent report on the water-power resources of the principal rivers of the state, estimates that by the development of available sites and storage reservoirs, the twenty-four-hour power of the rivers for 60 per cent of an average year may be increased from 658,268 hp. to a total of 766,443 hp. Under present conditions at the developed sites, 391,113 hp. are available for twenty-four-hour service for 60 per cent of an average year. At the undeveloped sites 267,155 hp. may be had on this basis. By the construction of suitable storage reservoirs the twenty-four-hour power for 60 per cent of the average year at developed sites may be increased to 438,903 hp., and that at the undeveloped sites to a total of 327,540 hp. The possibility of increasing the available energy supply is shown in the table.

SUMMARY OF WATER POWER REPORTS OF MAINE COMMISSION

		Present Conditions				Conditions After Regulation						
		Hp. Available with Low Water Flow, 95 per Cent Average Year		Hp. Capacity of Turbines for 24-Hour Power, 60 per Cent Average Year		Hp. Available with Low Water Flow 95 per Cent Average Year		Increase of Low Water Power		Hp. Capacity of Turbines for 24-Hour Continuous Power, 60 per Cent Average Year		Total Increase in Economic Capacity of Stream 60 per Cent Power
Basin	River and Location	At Developed Sites	At Undeveloped Sites	At Developed Sites	At Undeveloped Sites	At Developed Sites	At Undeveloped Sites	At Developed Sites	At Undeveloped Sites	At Developed Sites	At Undeveloped Sites	
St. John	Fish	0	3,660	0	0	0	6,400	0	2,740	0	0	.....
St. John	Allagash	0	3,662	0	0	0	8,679	0	5,017	0	0	.....
Presumpscot	Presumpscot	5,425	0	13,028	0	16,078	0	10,653	0	16,772	0	3,744
St. Croix	St. Croix	13,365	4,239	35,460	11,255	14,169	4,239	804	.....	37,616	11,255	2,156
Union	Union	1,555	0	5,480	0	4,490	0	2,935	0	6,530	0	1,050
Kennebec	Kennebec	26,170	50,140	61,590	127,490	56,090	105,760	29,920	55,620	71,580	161,880	44,380
Saco	Saco	11,200	6,570	23,680	13,850	23,600	14,550	12,400	7,980	30,070	17,070	9,610
Androscoggin	Androscoggin	76,720	28,530	113,700	41,590	85,310	30,870	8,590	2,340	118,020	42,770	5,500
Penobscot	Penobscot	29,425	22,550	64,875	37,100	40,250	31,100	10,825	8,550	70,175	43,450	11,650
Penobscot	East Branch	0	3,045	0	11,270	0	12,425	0	9,380	0	21,915	10,645
Penobscot	West Branch	62,700	21,100	73,300	24,600	69,890	23,450	7,190	2,350	88,140	29,200	19,440
Total		226,560	143,496	391,13	267,155	309,877	237,473	83,317	93,977	438,903	327,540	.....
Grand total		370,056		658,268		547,350		177,294		766,443		108,175

ASSURING CONTINUITY OF HIGH-TENSION TRANSMISSION

Cheap Insulator Is Expensive in Long Run—Careful Patroling and Prompt Repair Must Guard Against Fires Along Right-of-way

BY JOHN M. DRABELLE
Mechanical and Electrical Engineer, Iowa Railway & Light Company, Cedar Rapids, Iowa.

PROPER maintenance of high-tension lines is one of the most serious problems that confront the power transmission companies to-day; that is, to accomplish it economically and efficiently. The public and the public service commissions are continually increasing the rigidity of the requirements for continuity of service. To render with this characteristic service requires both the highest technical skill and the closest coöperation among the men upon whose shoulders rests the responsibility of producing it.

The maintenance problem on high-tension lines really begins with the original design of the line itself and its routing. A poorly designed and poorly built line will always be a line expensive to maintain. Here as elsewhere we get only what we pay for, and if second rate and third rate material enters into the construction, and if careless workmanship is tolerated, trouble is always sure to result.

The lower the voltage, generally speaking, the easier is the problem of maintenance, for at high voltages and extra high voltages many electrical effects manifest themselves that would not appear and need not be taken into account on the short, lower-voltage line. The selection of insulators is of prime importance. Insulators should be selected on the basis of competitive tests and upon operating information from other companies, rather than upon a price basis. A cheap insulator is a very expensive piece of porcelain. For example, on one large Iowa property the average cost of replacing an insulator is around $10.50, not including the loss of revenue during the time the line is out of service.

The maintenance of the high-tension line begins properly with the patroling, and the patrolmen should be selected with great care. A man who is quick to observe, quick to think and careful in all details of his work is the man who will make the best patrolman.

All poles and structures should be numbered, in order that a definite reference may be given to the men who are to make repairs. Trees should be kept carefully trimmed back from the line to such a distance that under the most severe wind conditions they cannot whip into the circuits, thus causing grounds and probable interruptions of service. On a wood pole line the guys should all be kept pulled up tight, as the guying of the line is its real strength. With transmission lines that follow railway right-of-way trouble may result in the summer and fall owing to poles being burned down by railway sectionmen burning the right-of-way. It is at this time of the year that particular vigilance must be exercised by the patrolman.

A small supply of maintenance material should be kept available at points not to exceed 7 miles to 10 miles (11 k.m. to 16 k.m.) apart. Insulators, pins, transmission-line conductor, splicing sleeves, tie wire and guy material, consisting of messenger, anchors and three-pole clamps, should be available. Thus long trips back to the storeroom can be avoided and considerable time saved, especially if an insulator has been partly shot away by hunters, or if there has been a severe windstorm.

PROVISION FOR EMERGENCY REPAIR IMPORTANT

In times of severe electrical or sleet storms the regular line crews at different substations or generating points should keep in touch with the substation operator or the system operator, as the case may be, so that they can be readily available in case of trouble. It is well to set aside in each large storeroom maintained by the operating company a supply of emergency line material, the stock of which should not be altered or changed by any one except the line foreman. If any material is used, it should be promptly replaced by the storekeeper in order that the supply may be "100 per cent available" at all times. In this way delays due to waiting for material out of the general store can be eliminated.

Each patrolman should be provided with some means of transportation. For the average conditions the Ford automobile is the most satisfactory of all. It will go in any kind of weather and over roads that are impassable to larger and heavier cars. The patrolman should always carry his belt, spurs and ordinary belt tools, and in addition should be provided with a chain for short-circuiting and grounding the high-tension line. For transmission lines provided with telephone circuits the Western Electric Code No. 1375-B telephone set provides an easy portable telephone, light in weight and quite efficient in transmission. The only difficulty with this set is that rather small batteries are employed to operate it, and these must be renewed at regular intervals even though they are apparently in operating condition.

The problem of maintaining the larger circuits constructed upon steel towers becomes one of distance, sectionalizing switches and insulators. The suspension insulator problem has not as yet been solved by any of the manufacturers, and apparently none of the operating companies has as yet devised any form of testing that can be said to be very satisfactory and reliable. The "megger," the high-frequency oscillator, the induction coil with telephone receiver and the "buzz stick" all have their several advocates, but as yet no one method apparently answers all requirements. The suspension insulator apparently deteriorates in the storeroom as readily as on the line; but whatever method is employed for testing maintenance insulators before they are sent out from the storeroom, the tests should be of such nature as not to overstrain and ruin the insulators before they go upon the line.

Outside of lightning disturbances, surges set up by switching and damage by windstorms the most fruitful source of trouble comes from malicious conduct. This takes the form of shooting at insulators by hunters and throwing of pieces of hay or telephone wire into the transmission line. This form of trouble can only be eliminated by proper laws on the statute books of every state, making the penalty severe enough to insure respect for the transmission line. If the penalty made is too severe it would be difficult to secure conviction before a jury, as corporations never receive kindly consideration. Then, further, a suitable reward must be offered for information leading to the arrest

and conviction of the party or parties causing the damage.

Finally, a complete set of rules and instructions should be drawn up by each company. The problems are so different and diversified that no detailed statement of these rules can be made, but in general they should embody instructions: (a) for patroling and inspecting, (b) for the reporting of trouble, (c) for the distribution of material and scheduled points along the line, (d) for the protection of the men making the repairs, (e) for assembling of the line crews in case of emergency, (f) for proper accounting for time and material.

SUPER-POWER LINE IS PROPOSED IN NORTHEAST

To Connect Generating Stations at Large Load Centers With Water Power and Steam Plants at Mines—National Matter Rather Than Local

In the territory between Boston and Washington, careful investigation will show, said W. S. Murray, conservation engineer before the A. I. E. E., that the wastage of energy is equivalent to about $300,000,000 a year. Considerable of this could be saved by erecting 220,000-volt lines to inter-connect 200,000- or 300,000-kw. stations at load centers in this district with hydro-electric plants and stations at the mouths of coal mines. Such plants would be equipped with 30,000- or 45,000-kw. generating units. The hydro-electric plants would not displace coal-burning stations, but would be in the ratio of about 7 to 93, unless extension of the lines into New England or similar territory would justify increasing the percentage of hydro-electric plants. With such large stations and generating units, and facilities available for transmitting power in bulk, energy could be generated with 10 lb. (4.5 kg.) of water per kilowatt-hour and delivered to the consumer at 12 to 15 lb. (5.4 to 6.8 kg.) of water per kilowatt-hour, as compared with an average rate of 25 to 30 lb. (11.3 to 13.6 kg.) based on data from plants in this territory, including industrial plants. By thus interlinking the large and highly economical plants at load centers it will be possible to benefit by the regional load factor rather than merely by city load factors. Investigations show that energy could be supplied to railroads in this vicinity at a load factor of 70 to 75 per cent, so that with the diversity of other loads the total load factor might be 50 per cent or higher.

This proposed development is of more than local importance, said Mr. Murray, because 40 per cent of the cargo space on the Atlantic seaboard is for coal, and the amount of fuel now needed is far greater than that which can be accommodated readily. While the economy and consequently the conservation of coal which can be effected by elimination of small plants should be of utmost interest to the country at large, it will probably be more greatly impressed by the relief of freight congestion which can be effected by generating power at the mouths of coal mines and in highly economical plants situated at load centers. The railways which now handle the coal would not be deprived of revenue by the reduced transportation of coal, because the provision of a trunk line such as proposed will cause industries to spring up in places which are not now favorable, with the result that high-rate carrier business will be developed, from which the railroads will certainly profit. The small generating stations will not be supplanted entirely, because they can be utilized during peak loads and as condensers during light loads. In other words, their life will be extended in a new field. Existing companies will not be affected in their corporate standing, because power will be generated in bulk and sold to them for distribution.

Financing of this development will require an appropriation from Congress. When this matter is discussed before that body it must be considered as a national proposition, and not as a local one, because the majority of finishing industries of the United States are in the Northeast, hence the entire country will benefit by such a development, reducing the price of finished products, increasing the productivity of labor, permitting competition with foreign countries in export trade, meeting labor prices, etc., to say nothing of the other advantages previously mentioned.

As a parting motto, Mr. Murray said: "Billions have been spent for destruction, so spend billions now for construction and conservation."

Philip Torchio characterized Mr. Murray's statements by saying that central stations are not concerned with who generates electric power but with the distribution thereof, provided equal cost and reliability is afforded. When this subject of super-power lines comes before Congress, he suggested that they give serious consideration to his remarks before the A. I. E. E. on Jan., 1918, which bear specifically on the problem. While long high-voltage transmission lines have usually been thought of as means of bringing energy from hydro-electric plants to a market, Mr. Torchio pointed out that hydro-electrically generated power will always be in the minority in the East, and that coal or some other fuel will have to be depended on for the majority of power used. Furthermore, because of the existence of large, highly economical central stations in the territory named by Mr. Murray, there will be very little difference in economy whether power is generated at coal mines or in large load centers, except that it may be possible to supplant more of the uneconomical isolated plants around the country. There would be the advantage, however, that the amount of coal which would have to be transported by rail would be reduced.

Mr. Torchio expressed the desire to go on record as having no selfish motive for presenting objections to super-power lines, but he does believe that just as big results will be obtained by concentrating on present centralization of power production, supplemented by elimination of small uneconomical plants. Additional benefits can be secured by eliminating the railroads' wasteful use of coal through electrification. This, together with the reduction in haulage of coal, should offer the solution to the handling of increased freight.

Regarding the load factor of electrified railroads, Prof. J. C. Clark of Stanford University said that a committee on the Pacific Coast has been collecting data on power demands, energy consumption, etc., and found that the load factors of the railroads will be much less than 70 per cent, the amount assumed by Mr. Murray. Furthermore, the assurance by state commissions to railroads of a certain profit regardless of methods of operation removes one incentive toward economy through electrification, hence it will be necessary to give considerable publicity to economies available through electrification of railroads, so that the public will demand the consideration of higher economy.

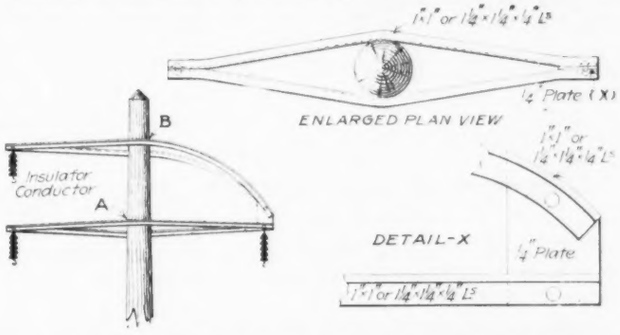
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

POLE CROSS-ARM MOUNTED WITHOUT FASTENINGS

Clamping Effect of Combination Cross-Arm, and Weight of Three-Phase Line, Prevents Line Support from Slipping Down the Pole

By making the cross-arms of a three-phase transmission line of steel angle iron instead of the wood, a transmission company in the South has been able to entirely eliminate the necessity of lag screws, bolts or



FRICTION AND POLE TAPER PREVENT CROSS-ARM FROM SLIPPING

any other fastening device usually used to prevent the cross-arm from slipping. The three-wire line is supported by an arrangement of four angle-iron pieces and a connecting plate as shown. The support is assembled and slipped over the top of the pole. When the lines are placed in position so that the arms are subjected to an unequal load it is claimed that the arrangment cannot slide down the pole on account of the friction, the pole taper and the clamping effect of the angle-iron crossarms. H. D. HAMMOND.

INSUFFICIENT WATER SUPPLY CAUSES ALTERNATOR HEATING

Water Turbine and Steam Turbine Operating in Parallel Could Not Be Adjusted by Reducing Field Current During Low-Water Season

If the simultaneous voltages of parallel alternators are not equal at every instant there will be exchanges of current between the machines caused by the one having the higher instantaneous voltage tending to deliver current to the machine generating the lower voltage. These differences in simultaneous voltage can be caused by difference in wave shape, lack of exact synchronism, improper adjustment of the field excitation, etc. Thus it can be seen that any attempt to adjust the load division between alternators by means of changing the field excitation will only result in aggravated cross-currents which will overheat both machines.

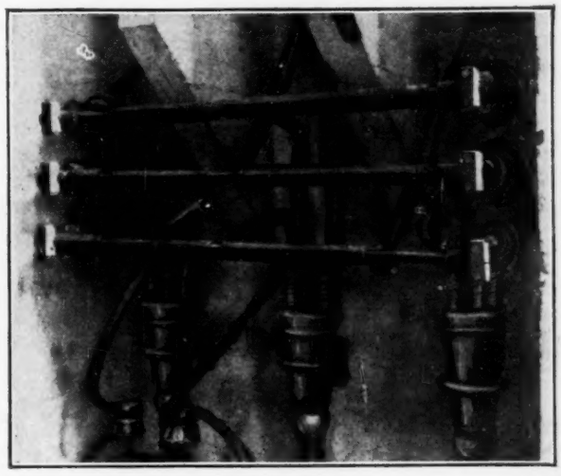
This fact was emphasized on one system where a water-wheel driven generator and a turbo-generator were operating in parallel and overheating. Overload alone might have accounted for the excess heating as the station load was 175 per cent of the sum of the ratings of the machines. Investigation disclosed, however, that there had been no cause of complaint until the beginning of the low-water season. The water-driven machine had developed a tendency to shirk its load, and the operator had been endeavoring to correct this tendency by reducing the resistance in the field windings. The result had not been satisfactory because the water-driven unit was operating below frequency owing to lack of sufficient water. In view of the fact that considerable further load was known to be coming and had been anticipated by the ordering of a larger steam-turbine set, the existing unsatisfactory condition was temporarily helped by slightly reducing the speed of the steam turbine until the generators equalized fairly well at 20 per cent overload. E. C. PARHAM.

Brooklyn, N. Y.

EMERGENCY ARRANGEMENT FOR MAKING BUS INSULATORS

Constructed from Standard Material When Delivery of Manufactured Insulators was Too Long and Installation Would Have Been Held Up

Having to make connections for the three outgoing distribution lines from one feeder on short notice when bus insulators were not available, the Kansas City



BUSES ARE CLAMPED TO PORCELAIN INSULATOR ATTACHED TO CONCRETE

(Mo.) Light & Power Company utilized standard material and constructed the insulators shown in the accompanying illustration. The insulators for each phase consisted of one standard pin for wall mounting, one standard 13,200-volt insulator, two pieces 1¼-in. by 1¼-in. by ⅛-in. by 4-in. long angle iron, one pair of

porcelain cleats, two 3½-in. by ¼-in. stone bolts, two 5½-in. by ¼-in. stone bolts, and one piece 1-in. by ⅛-in. by 3-in. iron.

The buses are clamped to the end concrete wall by means of porcelain cleats and at the other end to insulators. Taps connect the buses to the feeders which run to three potheads shown.

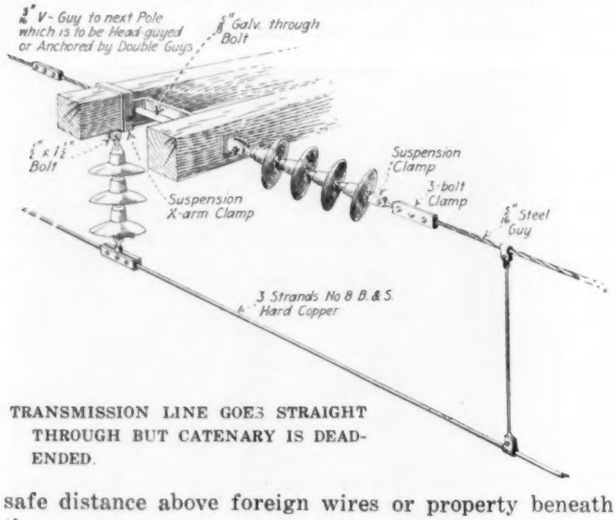
D. D. CLARKE,
Electrical Engineer.

Kansas City, Mo.

CATENARY CROSSING SPAN FAVORED OVER DEAD-END TYPE

Many Points of Suspension Prevent Broken End of Wire from Falling Low Enough to Touch Wires Under Crossing

Transmission lines crossing over telegraph or telephone lines must be so constructed that there is small likelihood of their falling upon the lower lines. Dead-ending the line on each side of the crossover prevents the wire from falling in this span if a break occurs on the outside, but it does not take care of breaks happening within the crossing. The Minneapolis (Minn.) General Electric Company has adopted a catenary form of construction which eliminates the dead-end and allows only a short wire to hang down in case of a break. The catenary span consists of a 0.25-in. (6-mm.) Siemens-Martin steel strand wire, stretching from the poles on each side of the crossing. This steel-stranded wire is supported on dead-end insulators but the conductor wire passes straight through on suspension insulators. It is suspended from this catenary span by means of a two-piece clamp and the catenary links which consist of 0.5-in. (1.3-cm.) rods with an eye at each end. These links or rods are so placed that a broken end of wire, regardless of whether it is the catenary or the conductor, will be supported by the links next to the break at a


⅜" V-Guy to next Pole which is to be Head-guyed or Anchored by Double Guys
⅝" Galv. through Bolt
⅝" x 1½" Bolt
Suspension X-arm Clamp
Suspension Clamp
3-bolt Clamp
⅜" Steel Guy
3 Strands No 8 B.&S. Hard Copper

TRANSMISSION LINE GOES STRAIGHT THROUGH BUT CATENARY IS DEAD-ENDED.

safe distance above foreign wires or property beneath them.

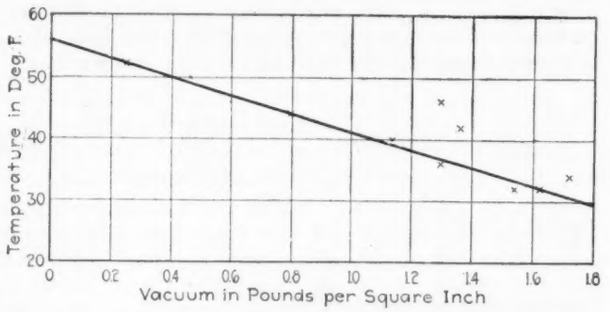
The engineers of this company think that the choking effect caused by angles of the conductor, which are found in the double-end crossing, are eliminated by this method. Also surges in the line are prevented from arcing over at these dead-end angles and causing a break at the place where breaks are the least wanted. The construction expense of this type may be greater than the dead-ended type but this is fully justified if accidents are prevented.

D. F. PARROTT.
Minneapolis, Minn.

PARTIAL VACUUM FORMED WITHIN CABLE SHEATHS

Cable Sealed in the Factory and Installed in Ducts at a Freezing Temperature May Fail on Account of Moisture Absorption

Absorption of moisture and eventual failure of high tension underground cables is not unlikely to happen when cables are intalled in cold weather, according to tests made by the Duquense Light Company of Pittsburgh some time ago. For this test one end of a 650-ft. (200-m.) reel of No. 5/0 three-conductor, paper-insulated, 11,000-volt cable was thoroughly sealed to prevent leaks. An empty test cap with a brass pipe soldered to it was wiped on the other end of the cable and tested under a vacuum of 26 in. (65 cm.) The



REDUCTION OF AIR PRESSURE INSIDE CABLES APPROXIMATELY PROPORTIONAL TO RISE IN TEMPERATURE

cable was then connected to a U-tube of mercury and kept at a temperature of 90 deg. Fahr. (32 deg. C.) for 19 hours. At the end of this time the vacuum in the cable was zero. Subsequent reductions in temperature of the cable were made during a period of 40 days. The curve produced is plotted between temperatures and vacuum in pounds per sq.in. The average change in pounds per inch per degree Fahrenheit change in temperature proved to be 0.068.

W. A. KEATING.
Pittsburgh, Pa.

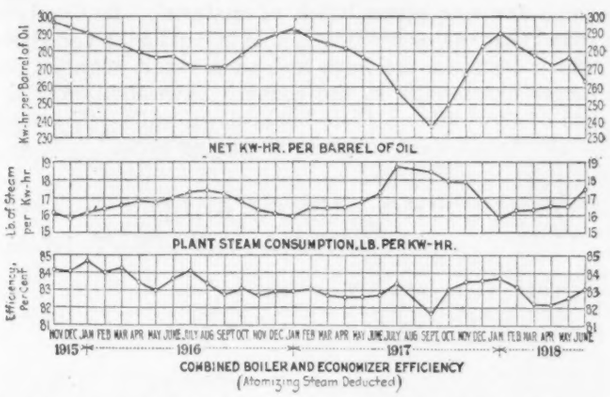
EVENLY DIVIDED LOAD EFFECTS HIGHER ECONOMY

Only 19,913 B.t.u. Per Kw.-Hr. Required for Oil-Fired Boilers in Medium-Sized Arizona Plant Under Normal Operating Conditions*

By giving especial attention to the adjustment of burners and distribution on the boilers, considerable economy has been obtained by the Inspiration Consolidated Copper Company in two of its power plants. With proper instruction to the operators the load was equally divided among all boilers. This was the best practice because the greatest efficiency was obtained at 60 per cent of rated capacity of boiler. With a material increase in per cent of rated capacity of boiler, the efficiency decreased. The equal distribution of the load was done automatically by the firing system and a diaphragm pump governor maintained a constant predetermined maximum pressure at the oil pumps. Furthermore an oil-to-burner regulator operates a throttle valve to give desired pressure at the oil burners and to insure quick response to increased load.

*Excerpt from paper presented before American Society of Mechanical Engineers on June 18, 1919, by C. R. Weymouth, entitled "Economy of Arizona Power Plants Using Fuel Oil."

From the curve it will be noted that the best monthly economy for winter conditions, has been 294.5 kw.hr. per bbl of oil or 20,910 B.t.u. per kw.hr. And the economy for summer conditions has been 275.5 kw.hr. per bbl. of oil or 23,700 B.t.u. per kw.hr. During the winter the economy is high on account of the cooler circulating water, while in the summer months the economy is lower due to the warmer water and the falling off of the vacuum. The decrease in the economy during the summer months is due to the smaller load and the substitution of the hydro-electric plant for the steam electric.



PLANT OPERATION CURVES FOR PERIOD OF SEVERAL YEARS

At the Cornelia plant of this company the economy is even better than that at the Inspiration. Here the greatest economy occurred in January, 1918, with a result of 326.2 kw.hr. per bbl. or 18,711 B.t.u. per kw.hr. Even when operating conditions are not ideal only 22,610 B.t.u. per kw.hr. are required. This difference is due somewhat to the larger turbine units installed.

PORTABLE SUBSTATION SERVES SUDDEN LOAD INCREASE

Used Until 15,000-Volt Transformers Could Be Obtained from Factory when Load Increased Several Hundred Per Cent in Short Time

Industrial plants are now usually constructed flexible so that a change in kind of production can be accomplished in a short time. This brings increased production which in turn may cause the need of additional electric power which cannot always be furnished in a short space of time. Such a case was presented to the Southern California Edison Company during the war when a structural iron works decided to build engines for the great number of ships that were then in demand. The sudden increase in load and the prospect of further increase necessitated substantial reinforcement in the form of transformer capacity. The plant had been supplied from two 2200-volt feeders connected to substations 1 mile (1.6 km.) and 2.5 miles (4 km.) distant, but it was found that the load could be more economically handled from a 15,000-volt system. Inasmuch as the necessary transformers could not be obtained for several months, a portable substation was used in conjunction with the existing lines to allow the plant to run at increased output. This substation consists of a 525-kw. air-blast transformer mounted on a truck together with a motor-driven blower and switchboard, all protected against the weather.

F. B. LEWIS,
Supt. Distribution, Los Angeles District.

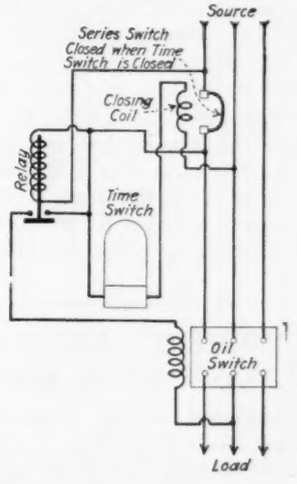
TIME SWITCH CONTROLS LARGE OFF-PEAK LOADS

Methods Used for Limiting Demand of Utility Customers During Stated Hours to Predetermined Values or to Cut Off Service Entirely

Time switches are not limited in their application to the control of electric signs and other small lighting and power loads. Small time switches are being used just as successfully, in conjunction with oil switches, to limit the hours of operation of central station off-peak power customers. When it is desired to cut off a service which is beyond the capacity of the standard time switches, an oil switch is used, and the time switch is connected in series with the no voltage release coil. The time switch is set to keep the no-voltage release circuit open during the hours when no service should be used, and the oil switch cannot be kept closed during this period.

A small amount of service can be furnished for lighting during the peak hours, as provided for in some contracts, by the use of a fuse which is shunted across the oil switch, when it opens. A special fuse is made up for this purpose by some companies, so that the customers cannot readily install a larger fuse if the one blows. When this practice is adopted, it is usual for the company to supply the customer with one or more spare fuses for replacement in case of emergency. This entire arrangement is only used on comparatively small installations where the expense of more extensive control equipment might not be justified.

A better way to control the amount of limited and unlimited three phase service is by the use of an automatic oil switch, a single pole electrically-operated switch, a series relay, and a time switch as shown here. The function of the time switch is to keep open the electrically operated switch, during the peak hours.



THREE-PHASE CONNECTIONS FOR REDUCING POWER CUSTOMERS' ALLOWABLE DEMAND DURING STATED HOURS

When the time switch opens during peak hours it puts the series relay in circuit with the oil switch. The no-voltage release coil of the oil switch is in series with the relay contactor, and if the line current going through the relay exceeds that which is allowed during peak hours, the relay will open the no-voltage release circuit, and trip the circuit breaker. This operation will be repeated if the circuit breaker is closed and the load current is too high.

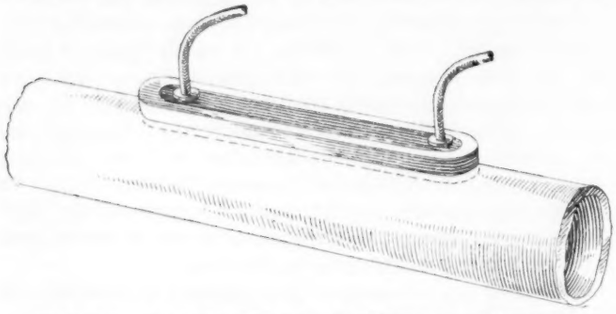
INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

CIRCUIT OUTLET MADE INTEGRAL PART OF CONDUIT

Top of Condulet is Sawed Off and Welded to Conduit Line to Enable Lamp to Be Attached to Power Circuit

Modern industrial lighting practice has tended to eleminate lamps for each machine tool, and has favored having lighting units attached to or suspended from the ceiling at regular intervals. This usually produces a high, even distribution of light which is sufficient for



CONDULET ELECTRIC WELDED TO CONDUIT LINE OBVIATES NECESSITY OF BREAKING LATTER

the needs of most of the operators, but some work, such as internal boring, requires a portable light for close inside measurements and individual lamps must be provided. Energy was effectively obtained for this purpose in an industrial plant by tapping the 220 volt motor circuit. A hole was cut in the main 2.5 in. (6.3 cm.) conduit and a tap was made directly to this circuit. In order to reduce the fire hazard and to make a neat-looking job, the top of a condulet was sawed off and welded to this pipe at the opening. The top wires were then run to a stand holding a lamp which was connected in series with another lamp to allow the use of 110-volt lamps.

WHEN FLYWHEELS ARE NOT NECESSARY WITH MILL MOTORS

Flywheels Eliminated From Breakdown and Cold Sheet Brass Mills With Gain in Efficiency—Loads Can Still Be Kept Steady

In the electrificati of brass rolling mills the cost of installing and operating flywheels can often be saved by a study of operating conditions. For instance, the function of a break-down mill is to reduce the thickness of a succession of 75 lb. to 90 lb. (34 kg. to 41 kg.) bars which are run through the rolls at a given speed. With the rolling mill speeds in common use for breaking down bars, the operator's aim should be to keep the entering end of each bar against the leaving end of the bar ahead. With this method of operation, there are considerable periods when the power requirements from bar to bar are within about 10 per cent of constant value for any given batch of material. It has been found that the motor is well able to handle the variations which occur in the load, and as a result some of the larger brass mills in the country have eliminated the use of flywheels on their break-down mills. The same is also true for cold sheet brass rolling mills.

CONDUCTING AUTOMOBILE GENERATOR HEAT RUNS

Twenty Generators Can Be Driven at Same Time from Single Shaft Directly Connected to Motor—Individual Drive Motors for Assembly Test

A test table designed to accommodate sixty-four automobile lighting generators for simultaneous heat runs is in use at the factory of Gray & Davis, Inc., Cambridge, Mass. Each table (Fig. 1) is about 60 ft. (18 m.) long and is provided with two driving motors rated at 15 hp. each. Each motor is directly coupled to a horizontal shaft 1½ in. (3.8 cm.) in diameter, which is carried along the table top and fitted at each test position with a 6-in. (15.2 cm.) pulley from which the lighting generator under test is given by a short belt

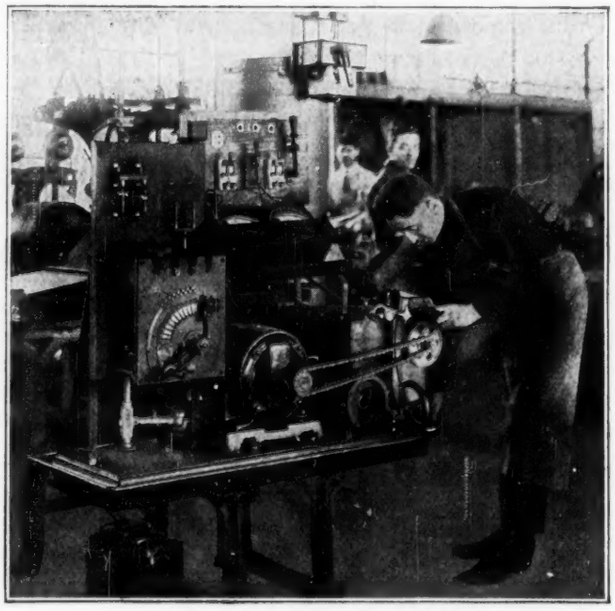


FIG. 2—ASSEMBLY TEST BEING CONDUCTED

connection. The generators are mounted in specially designed base clamps with belt tighteners.

The energy output of the generators, delivered at 6 volts, is carried by short leads to a pair of cables running horizontally beneath the test benches, one pair from each side of the test table. These leads are multipled at the rear of a switchboard panel shown in the

foreground, and after passing through a main switch the summated outputs of the units under test are carried to a storage battery in another part of the test room. The battery is discharged in other test service.

For a final assembly test of combined lighting generators and starting motors at this plant testing equipment like that in Fig. 2 is used. The unit is mounted on the engine frame as shown and is driven by a ½-hp. motor, the output of the generator being absorbed in a three-cell storage battery beneath the table. An inclined bracket provides space for ammeter, voltmeter and record pad, the motor starter being shown at the left. The entire outfit occupies a space only about 5 ft. (1.5m.) wide, and is provided with a platform gutter to recapture oil.

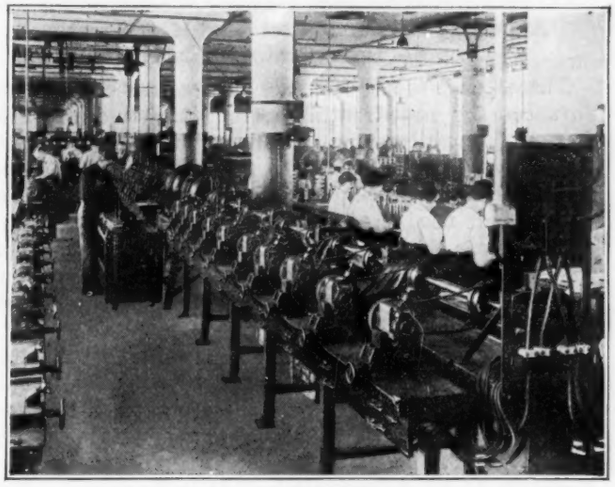


FIG. 1—AUTOMOBILE GENERATORS BEING DRIVEN BY SAME MOTOR AT END OF BENCH

F. F. WACKWITZ.

Cambridge, Mass.

OVERCOMPOUNDING CAUSES CHARGING-PLANT TROUBLE

Underload Circuit Breaker Continually Opened Without Cause Being Apparent Until Over-Compounding of Generator Was Noted

The operator of an electric delivery truck charging plant was having difficulty in keeping the cars on charge and called in the writer to make an examination of the equipment, which consisted of a second-hand motor-generator set and a new standard-type charging board. The motor was a three-phase, 60-cycle, 440-volt squirrel-cage induction motor directly connected to a 110-volt compound-wound generator. The complaint was that the motor was overloaded and that there was a ground on the generator's shunt field which caused its voltage to drop and in turn caused the underload circuit breakers to open.

After the load had been applied for an hour, however, there was no sign of the motor being overloaded, but two of its leads were quite warm, while the third was cool. This condition was caused by a loose connection in the lead from the running position of the starter. This trouble was corrected by cleaning and tightening the contact surfaces but still operation was not satisfactory.

Each charging circuit included an adjustable resistance and an underload circuit breaker. The latter was used to prevent the batteries from discharging in case the charging voltage dropped below the battery voltage and to disconnect the battery when its charging current dropped to a pre-determined value.

After watching the board for some time one of the breakers opened, soon another, and in a few seconds they were all out. It happened so quickly that the cause could not be detected. The operator was instructed to put the cars back on charge in the usual manner. As the load was added the field rheostat had to be changed to keep down the voltage. In about fifteen minutes the breakers were out again and the generator voltage was down to 80 volts.

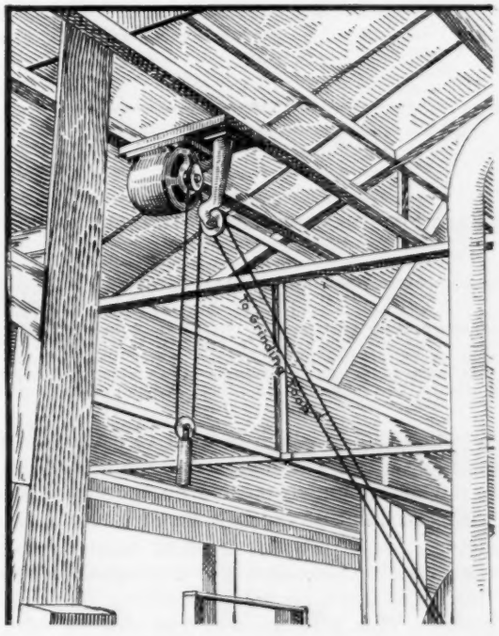
Increasing of the voltage as the load was added indicated overcompounding of the generator. This would also cause the generator voltage to drop as the batteries became charged because the load would decrease. This trouble was corrected by connecting a shunt of german-silver wire across the series-field winding and adjusting it to give flat-compound characteristics.

Washington, D. C. R. L. HERVEY.

TOOL-GRINDER MOTOR PLACED CONVENIENT TO WOOD MACHINE

Instead of Using Portable Mounting Which Would Take Time and Labor to Set Up, the Grinder Motor Is Mounted Overhead on Rack

In order to conserve time where large woodworking machines are used, some method has usually to be provided for grinding the cutting tools without removing them from their positions. This is effectively accomplished in a box factory in Brooklyn, N. Y., by mounting the motor overhead so that a round belt can be run to various positions. For mounting the motor two timbers were laid across adjacent overlays and angle-irons fastened as shown in the illustration so that the motor could be mounted upside down. Instead of running both sides of the belt from the grinder direct to the motor, only one side runs direct, the other passing through one fixed and one movable pulley. The latter is weighted to keep the belt taut regardless of where the grinder is placed.



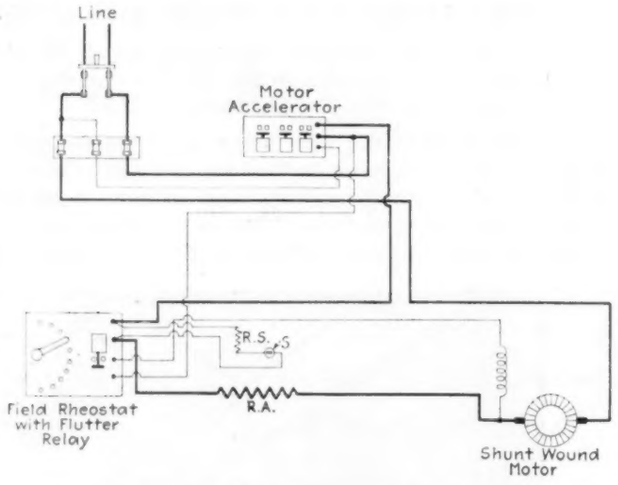
MOTOR ON CEILING IS ACCESSIBLE BUT NOT IN THE WAY

MOTOR DROPS IN SPEED AS METAL IS WOUND ON BLOCK

Flutter Relay in Armature Line Maintains Constant Tension on Metal by Cutting Resistance In and Out of Motor Field Circuit

One of the problems in a brass rolling mill is to get a motor-driven winding block which will coil the rolled strips without stretching the metal or stopping the motor as the metal winds up and increases the block diameter. The metal should be under a uniform tension while it is being wound, and as the metal leaves the rolls at a constant speed, it follows that if properly motored the power requirements of the winding block will also be a constant quantity. Attempts have been made to perform this function with slip belts and clutches, which, however, did not prove very satisfactory.

The desired results have been accomplished electrically at the Bridgeport Brass Company by the use of a flutter relay installed in the armature circuit of a



CONNECTIONS FOR CONSTANT POWER INPUT TO WINDING BLOCK MOTORS

The flutter relay mounted on the rheostat is in series with the motor armature and cuts resistance into and out of the field circuit as the load on the motor gets below or above normal. The amount of resistance used in the field circuit may be regulated by the rheostat. The resistance *RA* is inserted when the minimum or full field speed of the motor is too high. The tension on the metal being wound can be increased by closing the switch *S*, which shunts the resistance *RS* across the coil of the flutter relay.

shunt-wound motor which is used to drive the winder. When the input to the motor exceeds a predetermined value, indicating undue tension on the metal, the relay cuts resistance out of the field circuits and slows down the motor. When the motor input becomes subnormal and the tension on the metal is not sufficient to keep it taut the relay cuts in field resistance and speeds up the motor. This arrangement has worked very satisfactorily in practice and has given the constant tension desired in the metal being coiled.

The success of the application depends almost entirely on the selection of the motor, which must have a high enough maximum speed to give the winding block a higher peripheral speed than that of the rolls, and the full field speed should be low enough to insure that with the maximum amount of metal on the winding block the peripheral speed of the coil will be lower than that of the rolls. With the correct motor and the proper resistance adjustment an ammeter placed in the line has shown a practically constant current, which means that the metal tension is equally constant. An adjustable shunt to the coil of the flutter relay can be installed to give various definite tensions through considerable speed variations in the motor.

Bridgeport, Conn. W. R. CLARK.

ELECTRIC HEAT TREATING BECOMING FAVORABLE

Suitable for Soaking Pits, Heating Blooms and Billets Annealing Bars and Sheets and Heat-Treating Drop Forgings, Castings, Rails, Etc

Three conspicuous examples of the use of electrical furnaces for heat-treating were afforded during the war—(1) heat-treating Liberty motor crank shafts (over half being so treated); (2) heating all cast-steel anchor chain made, and (3) treating drawbar knuckles (about half used in America being so heated). With modifications the furnaces are suitable for soaking hot-stripped ingots, heating blooms and billets, annealing bars and sheets and heat-treating drop forgings, castings, rails, etc.

The wall losses for a typical soaking pit holding sixteen 3-ton ingots will not exceed 1000 kw. and should be considerably less. When operating on hot ingots with a soaking time of one and one-half hours the capacity will be 32 tons per hour and the energy consumption 35 kw.-hr. per ton. It is to be expected that the cost of heating by electricity will be in excess of that with gas-fired pits, but elimination of roll breakages due to cold ingots, avoidance of delays in the mill due to unevenly heated ingots, reduction of oxidation (perhaps one-half of 1 per cent), as well as ability to save labor, should more than offset the increased cost. On the other hand, starting with ingots at 1800 deg. Fahr. (980 deg. C.), which must be raised 300 deg. Fahr. (150 deg. C.), the capacity would be reduced to 24 tons per hour and the energy consumption increased to 60 kw.-hr. per ton, whereas with 1500-deg. Fahr. (810 deg. C.) ingots the capacity would be 24 tons and the energy consumption 90 kw.-hr. per ton.

One all-electric billet-heating furnace, rated at 600 kw. in actual practice, handled 1½ tons of steel per hour, with an energy consumption of 450 kw.-hr. per ton. Under more favorable conditions this could have been reduced to 300 kw.-hr. per ton, so that the cost would favorably compare with fuel-fired furnaces of similar capacity and besides eliminate 2 to 5 per cent of the scaling occurring otherwise. For reheating 1800-deg. billets leaving one mill before they enter the finishing mill, about 60 kw.-hr. per ton would be required; furthermore, about one-fourth of 1 per cent of the metal would be saved, which, at the price of $40 a ton would be a saving of 10 cents a ton.

Recuperative car-type furnaces adapted to annealing cold-rolled strips and sheets can be operated with a power demand of 550 kw. and an energy consumption somewhat under 120 kw.-hr. per ton running full capacity. Covers can be eliminated, which means reduction in experience and labor and increased precision in annealing. Alloy steel, which must be soaked for forty hours at a temperature of 1400 deg. Fahr. (760 deg. C.), would require 800 kw. for a furnace having an output of 75 tons a day and would consume 250 kw.-hr. per ton, due to the larger heating chamber required.

The above information was contributed by T. F. Baily of Alliance, Ohio.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

RECORDS OF CUSTOMERS KEPT IN COLUMBUS OHIO

Simple Yet Thorough System Employed Is Illustrated by Some of the Forms Used to Facilitate Business Operations

The simplicity yet thoroughness of the system followed by the Columbus (Ohio) Railway, Power & Light Company in keeping records of customers can be best understood from a brief description of some of the standard printed forms and their uses.

For instance, the contract itself, which is the first negotiation between customer and company, is simple and short. Some few clauses are printed on the back concerning the company's right to enter premises, discontinue service for non-payment, etc., but the gist of it is in very short form.

With the contract the customer has the option of furnishing a guarantee of payment for service, signed by some property owner, or of making a deposit of from $3 to $5. If the latter prerogative is taken, a deposit receipt in triplicate is filled out, and on the back of the duplicate a space is provided in which the customer is directed to "sign here for identification." The original receipt is given to the customer, the duplicate is sent to the cashier, and the triplicate retained for the new-business department file. Then when any one comes in and presents a deposit receipt for cashing he is asked to indorse his name on the back of it, and his signature is compared with that on the duplicate in the cashier's file. This also provides for the case where the customer is discontinuing service and comes after the deposit but has lost the receipt.

The customer is asked to sign his name to a receipt for the money, and this signature is compared with that on the duplicate of the original. If this does not compare, of course, further investigation is made. This eliminates the necessity of making affidavit.

The "preliminary file" kept to hold the records of customers tells about the work the company is doing to be ready to turn on the current for the new customer almost the instant he asks for it. This is thought to be an important part of the service renderable. A form is provided which is filled out by the man sent out to look over a new house. On the back of this he makes out an estimate of the items of material required and the cost of connecting the customer. This information then goes to the preliminary file, and everything is completed, so far as the company is concerned, that can be done until the contract is signed, including information from which to tell the contractor where to put his meter loop when he calls in.

THE SYSTEM OF CUSTOMERS' RECORDS DEVELOPED BY THE COLUMBUS RAILWAY, POWER & LIGHT COMPANY FACILITATES REFERENCE, SAVING TIME AND TROUBLE

ORIGINAL

Contract for Electric Service

Contract made this ..... day of ..... 191.... between The Columbus Railway, Power & Light Company (hereinafter called the Company) and

..... (hereinafter called the Consumer.)

The Company agrees to furnish to the Consumer at .....

all electric energy required or used for ..... for a period of ..... year...., from the date service begins under this contract, and thereafter until 30 days' written notice to discontinue shall have been given by either party to the other.

The Consumer agrees to pay monthly for all electric service at the rates specified in Schedule ..... of the Company's rates on file with the Public Utilities Commission of Ohio.

The Consumer agrees to pay a minimum monthly charge of .....

This contract can not be transferred or assigned by the Consumer.

All agreements, terms and conditions on the back of this contract shall be deemed a part hereof.

..... Consumer.

THE COLUMBUS RAILWAY, POWER & LIGHT COMPANY.

By ..... Contract Agent.

Bills to .....

Guarantee No. .....

Circuit .....

Route .....

Classification .....

AT YOUR SERVICE

Form 385A 8-24-15-2m

GUARANTEE

Contract No. .....

Card No. .....

Columbus, O., ... 191....

In consideration of The Columbus Railway, Power & Light Co. furnishing Electric Power, Light, etc. to .....

at No. ..... Street

I, being the owner of Real Estate located at .....

..... in the City of Columbus, O., the cash value of which is ..... Dollars, over and above any encumbrances on same, do hereby guarantee the full payment of all bills, for any sixty days' supply of Electric Power, Light, etc., served to said applicant at above address.

Signed .....

Witness .....

Address .....

Address .....

THE COLUMBUS RAILWAY, POWER & LIGHT CO.

DATE .....

ESTIMATE SERVICE FOR

LIGHT .....

POWER .....

FROM TRANSFORMER NO. .....

COILS, EDISON ..... A. C. – S. C. – 550V

COILS, L. H. & P. .....

NAME .....

ADDRESS .....

BUSINESS .....

SERVICE TO ENTER .....

COMBINE WITH LINE ESTIMATE FOR .....

Form 475-NE 5-21

Columbus, Ohio, ...

For value received, I herewith transfer to THE COLUMBUS RAILWAY, POWER & LIGHT CO., ownership and all right to the deposit of ..... dollars for current to be used by ..... at ..... Original Deposit Receipt No. ..... Being unable to produce said Original Receipt and which receipt has not been assigned or disposed of by the undersigned.

Witnesses: ..... Signed .....

GETTING THE OLD HOUSES WIRED FOR ELECTRICITY

Campaign of Patchogue Electric Light Company Shows that Under Present Conditions Owners of Old Houses Are Disposed to Make Improvements

Owing to the unusual conditions surrounding building construction at this time, the central station can make a special appeal for wiring old houses. While there is some construction of new dwelling houses to meet urgent demands, the owner of an old house finds that it has a greater value than he realized and he is disposed to make improvements to raise its standard.

R. R. Hawkins, treasurer and general manager of the Patchogue (N. Y.) Electric Light Company, has found it profitable to make a liberal offer to secure customers living in old unwired houses. Hand bills were distributed at every unwired house in the community and canvassers called later and secured signed cards, which they then turned over to electrical contractors. Before starting the campaign the company called together the electrical contractors in its territory. The company agreed to pay the cost of installation of one lighting fixture, and customers of course could select what contractor they chose to do the work. It was almost the exception where a person accepted the offer of the company alone; usually he had the entire house wired.

In communities where there is still a relatively large number of unwired old houses present conditions justify vigorous effort to introduce the opening wedge for electric service.

STANDARD FOR WEIGHING PUBLICITY OF UTILITIES*

How to Present It, What Special Difficulties Are to Be Avoided in Its Use and What It May Be Expected to Accomplish

BY BERNARD T. MULLANEY
Director Illinois Committee on Public Utility Information

In summoning to the utilities publicity's skillful aid, let it be artful in the sense of being skillful and ingenious, but be careful that it is not too artful in the sense of being tricky, crafty, cunning or artificial. The first requisite of publicity effort that is to be more than temporary, is that it shall "come clean"; it must be honest, open and aboveboard, it must be presented without false pretenses, without specious argument and without special pleading. If utilities haven't a case good enough to stand on its merits, publicity should be shunned as a pestilence.

The place to start publicity effort for utility companies is in the home town newspapers. The way to start it is by using that paper's advertising columns for boosting the company's business. Then utilities will find that being a customer of their home town newspaper publishers is a long step toward becoming a friend of those publishers. Moreover, it is easier to talk to a friend about a problem which only helpful publicity can cure than it is to talk to one entirely uninterested. But do not expect to buy the publisher's unqualified support by using his advertising columns. Utilities have no right to expect that. He gives full value received in the advertising space he sells, if the buyer makes proper use of it. All that utilities ought to expect in return for using his advertising columns is the right of a customer and friend to talk to him about collateral problems.

Then take another step. Make news for the home paper. The newspaper publisher lives on the news that he prints. It is a theory among outsiders that he lives on the advertising revenue of his newspaper, and he does in a narrow, literal sense. But if he does not have news to sell to his readers and so build up a circulation he will not be able to sell advertising. So make news for him. When a utility man or company is starting something — doing anything — tell the home paper about it. When something arises in connection with the utility business, that makes the business a source of news, talk it out with the public through the newspapers. Unpleasant things may be said of the utilities, but if it keeps up its end of the discussion the unpleasant things will finally disappear.

Every branch of the public utility industry needs sound, public opinion on its side to make the business safe. The only way to get that public opinion is by publicity. Getting the publicity lies primarily with the home town paper of each company. Let each utility man cultivate that field honestly and intelligently. Then the "public utility question" will disappear from controversy and the business will be as sound and as solid and as immune to attack as the public schools.

*From a paper before the Independent Telephone Association, Chicago, June 25.

ACCURACY ASSURED IN NOTING LOAD CHANGES

Hartford Company Uses Convenient Method to Obtain Information from Industrial Customers Concerning Such Variations

To facilitate notification of connected load changes by its industrial customers the Hartford Electric Company, Hartford, Conn., has devised a method which insures accuracy and is at the same time more convenient than the old one. A blank form is sent to the customer with sections devoted to light and power changes and with headings for locations, make, size, number of lamps, etc. This form is filled out by the customer and returned to the company. Formerly the company relied upon a letter from the customer, which in many cases lacked specific information.

Date.....19..

THE HARTFORD ELECTRIC COMPANY,
Hartford, Conn.

ATTENTION OF THE INSTALLATION DEPARTMENT

GENTLEMEN:—The following changes have been made in our installed load during the past month:

POWER

Location	Installed Make	Size	Series No.	Factory No.	Cut-Out Make	Size	Series No.	Factory No.

LIGHT

Location	Installed No. of Lamps	Size	Cut-Out No. of Lamps	Size

Remarks:

Kindly use the revised connected load in making out bill for the current month.

Yours very truly,

.....

DIGEST OF ELECTRICAL LITERATURE

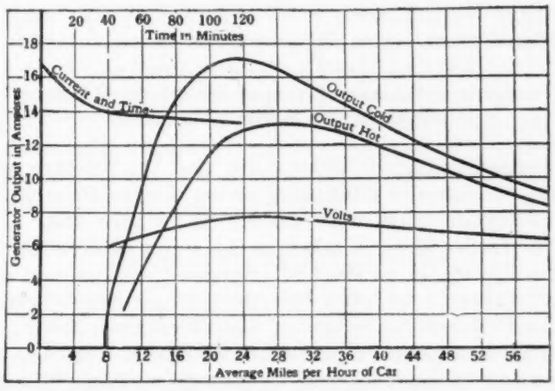
Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Motors, Generators and Transformers

Flat Spots on Commutators and Collector Rings.—WARREN C. KALB.—The writer shows that flat spots are closely associated with the problem of vibration of commutators, brushes and collector rings. The common difficulties from which such spots arise are enumerated and various remedies suggested.—*Power*, May 20, 1919.

The Synchronous Motor as a means of Reducing Costs.—ROBERT TREAT.—The author illustrates the possibilities of reducing power costs by the use of synchronous motors or motors condensers. Under the usual conditions, where the induction motors on a circuit have lowered its power-factor, the addition of a properly selected synchronous motor will improve the service and increase the power capacity.—*General Electric Review*, May, 1919.

Regulation of Automotive Generators.—W. A. DICK.—These generators must maintain a suitable output: (1) Over a wide speed range of at least five or six to one; this would correspond to a car speed from 10 to 50 or 60 miles (16 to 80 or 96 km.). (2) Preferably it should give a greater output in winter than in summer, because the longer nights of winter require a greater use of the lights and the engine requires longer cranking



OPERATING CHARACTERISTICS OF THIRD BRUSH GENERATOR

by the starting motor. (3) It must not overcharge the battery injuriously and yet it should give sufficient output to keep it charged. (4) It must require little attention and be unaffected by the heat of the engine or by oil and water. The shunt-wound generator, the straight bucking series type, the bucking series type with adjustable output and ballast control, and also the third brush type of generator, are discussed in particular.—*Electric Journal*, April, 1919.

Adapting Automatic Control to Motor-Started Converters.—R. J. WENSLEY.—While motor-started rotary converters are not being built at the present time, there are a large number of such converters in service. Automatic control for starting of these machines has been developed by the Westinghouse Electric & Manufacturing Company. Reactance synchronizing was adapted for the automatic control on account of its relative simplicity. In this scheme the machine is brought up to approximate synchronous speed, the motor is then cut off, and the machine is thrown onto its transformer through reactance of sufficient magnitude to limit the flow of current to less than full load. When the machine is in step the reactance is short-circuited, thus connecting the transformer directly to the converter rings. The direct-current switches may then be closed and the load put upon the machine. The equipment described is for a 300-kw. converter, which is brought up to speed, synchronized and got under load in from thirty to fifty seconds.—*Electric Railway Journal*, May 17, 1919.

Lamps and Lighting

The Ultra-Violet and Visible Transmission of Eye-Protective Glasses.—K. S. GIBSON and H. J. MCNICHOLAS.—Eighty-two samples of eye-protective glasses have been studied in regard to their transmission of ultra-violet light and visible radiation. For each specimen are given the trade name, the dealer, the color, the thickness, the per cent transmission curve from 230$\mu\mu$ to 700$\mu\mu$, and the total transmission factor for visible radiation. Previous work is outlined, methods and agreements are discussed, and comparisons are made of the various glasses as regards their protection against ultra-violet radiations.—*Bulletin No. 119, U. S. Bureau of Standards*, June 7, 1919.

Generation, Transmission and Distribution

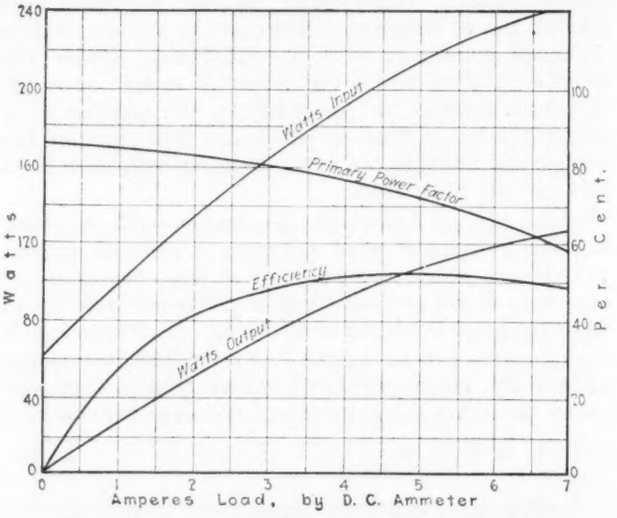
Pulverized-Coal Systems in America.—LEONARD G. HARVEY.—The paper deals with an elaborate report given by the author upon his return from Great Britain after a study of pulverized-coal systems in America.—The conclusions of the author may be briefly summarized as follows: (1) The advantages of burning coal in pulverized form has been definitely proved in actual practice. (2) The values of coal can be utilized to a far higher degree by this means of firing than by any other process. (3) In certain circumstances initial cost of pulverized-coal plants has been considerably less than the cost for installing producing-gas plants. (4) Economy in fuel consumption from 20 per cent to 50 per cent can in many cases be effected by the use of coal in pulverized form. Of the 513,500,000 tons of coal used in America in 1914 for all purposes, of which say 205,400,000 tons were used in the metallurgical and steel industries and for railway locomotives, some 41,000,000 tons would have been saved if pulverized coal had been used. (5) There is little or no economy to be effected by the introduction of pulverized coal-burning apparatus in substitution for existing efficient mechanical stoker installations, but for initial installations the latter plant can be installed at a lower cost and will show increased over-all economies over mechanical

stokers. (6) Almost any grade or quality of fuel—anthracite, bituminous, lignite or peat—can be used efficiently in certain circumstances, in pulverized form. (7) High ash fuels, containing 30 per cent or 40 per cent ash, can in some cases be used. (8) Large quantities of what is considered waste coal can be used to good purpose, and culm and slack heaps at mines can be at once turned to profitable account. (9) In suitably designed plants there is practically no danger whatever of the explosion of coal dust. (10) With the precautions as to limited storage recommended, spontaneous combustion introduces no difficulties. (11) The slag or dust resulting from the ash in coals can be conveniently and effectively handled and removed from all classes of melting and heat-treatment furnaces, stationary boilers and locomotives, small furnaces such as rivet-heating furnaces being an exception. (12) A very important start has been made in connection with the firing of large power-house boiler plants by this means, and its extension in this direction is likely to develop rapidly. (15) In view of the attention now being given to marine boiler firing by this means, useful and important results are to be expected. (14) Owing to the very considerable reduced amount of labor incidental to a pulverized-coal plant, as compared with hand firing and in certain cases stoker firing, the labor saving is a most important feature introduced by this system of burning coal. (15) In view of the smokeless combustion of pulverized coal in metallurgical furnaces, and especially in the steel industries, for boiler firing and for locomotives, the abatement of the smoke nuisance in large cities by this means can be accomplished to an appreciable extent.—London *Electrician*, May 30, 1919.

Installations, Systems and Appliances

Developments in Electric Iron and Steel Furnaces.—JAMES BIBBY.—The writer states that the profitable application of the electrical process in the reduction of ore and the manufacture of pig iron is limited to those districts where cheap electrical energy can be obtained. The chief advantage of the electric furnace over the blast furnace is in securing a uniformly distributed high temperature. In discussing the performance of reducing furnaces of about 4000 hp. the author states that one of the most important points for consideration on the electrical side is the arrangement of the low-tension leads. Each lead has to take current of practically 20,000 amp., therefore the greatest care must be taken to avoid induction. As an example of the losses which may occur in the low-tension leads, it was found in a test on an early furnace that the output from the transformer was about 4000 kw., but the input to the electrodes was 3400 kw., showing a loss of 600 kw. The losses were distributed as follows: In the contact clamps at the electrodes, 120 kw.; in the resistance of the leads, 165 kw.; by induction, 315 kw.; total, 600 kw. In steel making, the author states, electricity has advantages which place it well ahead of other heating systems. The chief of these advantages is that the heat can be supplied in easily regulatable quantities and intensities, free from contaminating gases. Moreover, the process can be carried on in a reducing atmosphere, which is of much importance. He states that the principal technical development will take place in larger furnaces. These furnaces may be used either for the complete process of melting, refining and alloying, or may be run in conjunction with Bessemer or open-hearth furnaces, being used to refine the cruder metal from those furnaces. In conclusion the author states that experience shows that engineers should fully grasp the requirements of the metallurgists and be fully acquainted with the working conditions of blast furnaces and steel foundries.—London *Engineering*, May 16, 1919.

The Tungar Electrifier—Its Theory, Characteristics and Application.—F. KEITH DALTON.—The underlying principles of the Tungar Rectifier were dealt with in the issue of the *Electrical News*, May 1. The performance of the single-phase rectifier as sold at the present time is now outlined, and in addition the various advantages of different possible combinations of two or more single-phase rectifiers are discussed. In the figures are shown the operating characteristics of a half-wave rectifier. The power factor applies only on the supply side of the rectifier and with noninductive load. The



OPERATING CHARACTERISTICS OF A HALF-WAVE TUNGAR RECTIFIER FOR BATTERY CHARGING

impressed voltage is alternating, and the primary currents, though also alternating, have a wave form which is not symmetrical with respect to its zero line. The power factor, then, is taken as the result of dividing input watts by the product of impressed voltage, and primary currents as read by alternating-current instruments. Numerous types of rectifiers are shown and characteristic curves presented therewith. Special attention is given to arrangements of rectifiers for use on polyphase systems.—*Electrical News*, May 15, 1919.

Steel-Mill Electric Drive.—BRENT WILEY.—During the war many steel mills which had hitherto been steam-engine-driven substituted electric drive for all additions to existing plant. The fact that electrical equipment could be put in quickly and at smaller expense was responsible principally for this change. The electric drive has been fully justified, and the writer looks forwards to an increase in the electrical operation of the steel mills. A more common use of central-station power has been made during the war period in particular. It has been a factor in facilitating installations and also offers many advantages in reduction of first cost of plant, reduced cost of operation, and in permitting greater flexibility of plant layout for future improvements. More than 50 per cent of the motor equipments installed during the last two years use central-station power and more than 60 per cent are 60-cycle

units. The tendency toward the adoption of 60-cycle apparatus as a standard is very marked.—*Electrical Review*, May 10, 1919.

Electric Welding: Its Theory and Practice.—H. S. MARQUAND.—In this article the author describes some power plants for the supply of energy for arc welding, and in particular makes a brief comparison between direct and alternating processes. He states that the direct-current process should be used where possible, but that the alternating-current system is satisfactory where proper skill in the operation is available.—London *Electrician*, May 23, 1919.

Progress in the Electrification of Mine Hoists.—R. S. SAGE.—The history of the electrification of mine hoists is narrated in this article, which traces the subject from its modest beginning in the early days to its practically universal application of to-day. The requirements of a mine hoist are described and the advantages of electric drive are explained. The latter pages of the article are devoted to a description of the various parts of the modern highly developed mine-hoist equipment.—*General Electric Review*, May, 1919.

Electric Welding: Theory and Practice.—H. S. MARQUAND.—The present article deals particularly with wire welding, the preparation of the work, regulation of the current and the power necessary for making resistance welds of this sort.—London *Electrician*, May 2, 1919.

Wires, Wiring and Conduits

Electric Supply to Small Consumers.—It is said that before the use of electricity becomes general in houses of moderate size a cheaper service connection should be made possible. The writer divides the cost of making this connection into excavation and reinstatement, cost of cable, joint boxes and jointings. He says the use of 7-18 s.w.g. twin cable is generally used for making connections of this sort, but the carrying capacity of these cables is over ten times the maximum possible demand of such small installations.—London *Times Engineering Supplement*, April, 1919.

Electrochemistry and Batteries

Advantages of Electric Vehicles for Transport of Goods.—C. T. OPPERMAN.—The cost of transportation of goods at Croydon is given for a number of specific cases. Relative advantages of lead and nickel batteries are also discussed with special reference to their suitability for use in the propulsion of trucks.—London *Times Engineering Supplement*, April, 1919.

Electrodes of Alkali Cells.—French Patent No. 487,881 of A. M. Cave describes a mode of manufacturing the electrodes of an alkali cell in which the oxides are homogeneous and sufficiently conducting. The electrodes are constructed on a base of nickel sheet plate perforated with holes. Around this plate is wrapped a sheet of nickel gauze, the meshes of which are filled with oxide or a mixture appropriate to the polarity of the electrode. The whole is covered by a wrapping of vegetable or mineral fiber that is permeable to gas, held in position by fibers impregnated to resist the action of alkali. Thus assembled, the electrode is compressed so as to produce an intimate contact between the gauze and paste.—*Technical Supplement to Review of Foreign Press*, April 29, 1919. (Abstracted from *Revue Générale de l'Electricité*, March 29, 1919.)

Telegraphy, Telephony and Signals

The Fullerphone.—A. C. FULLER.—This system consists of the use of a telephone receiver in the usual telegraph circuit, and its application to military and civil telegraphy is taken up in this article. A simple way of producing a note in the ordinary telephone receiver is to pass a current through the receiver and to interrupt it at the required frequency. This vibrator system had been used to a considerable extent as the sets were robust and required but little power. But it suffers from interference, the signals can be read at immense distances from the line, and it is impossible to superpose the system on telephone lines. Good results are possible when something less troublesome than the vibratory current is substituted for it. The solution appeared to be the provision on the line of a direct current as in ordinary single-current Morse, but of as low a value as possible, at the same time converting the energy thus transmitted into vibrating or pulsating currents at the distant end, and, further, such vibrating or pulsating currents had essentially to be closely confined to the distant end and prevented from surging back along the line. It is suggested that the Fullerphone can replace the Morse sounder sets on any hand-worked line. The advantages to be expected include the following: (a) Great saving of battery power; (b) simplicity of office wiring and manipulation of instruments; (c) very long distances can be covered without translation or relaying; (d) maintenance of lines can be reduced to a minimum; (e) lines may be of very high resistance—strength would probably become the ruling factor rather than conductivity; (f) lines may be very leaky and contacts with foliage, etc., are of slight importance; (g) no disturbance whatever is caused to neighboring or parallel telephone circuits, and no disturbance need be feared to telephone circuits when the Fullerphone is superposed; (h) it will be possible to work long stretches of land line and then cable and land line again without any conversion or retransmission. These possibilities have not yet been tested to the limit.—London *Electrician* May 9, 1919.

Miscellaneous

Designing Molded Insulation.—W. H. KEMPTON.—The following specific suggestions are offered as a help to the designer in getting his design ready for criticism by the manufacturer: (1) The simpler the form of the molded block the better and cheaper. (2) All vertical sides should be tapered in the same direction. (3) Rounded corners on the outer edge of both top and bottom faces require liners in the mold. (4) Avoid so far as possible the molding of holes in the sides of blocks. (5) Do not call for a molded thread if it can be avoided. (6) Threaded metal inserts may readily be molded into the top and bottom faces of the block. (7) Specify inserts molded in the sides of a block only as a last resort. (8) Avoid imbedding large pieces of metal in a molded block.—*Electric Journal*, April, 1919.

The Colleges and the War.—FRANK P. MCKIBBEN.—The author deals with the depletion of the engineering colleges due to the war, pointing out improvements which he believes should aid in building up these institutions again. The problem of improving the financial status of the faculty and other ways of making teaching more effective are discussed.—*Bulletin Society for Promotion of Engineering Education*, May, 1919.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

SUCCESSFUL STOCK SALE AT PROVIDENCE, R. I.

Narragansett Lighting Company, After Acquiring 4000 Shares in Open Market, Sells Them to Customers in Lots of From One to Five Shares

A campaign designed to increase the number of stockholders of the Narragansett Lighting Company, Providence, R. I., has just been completed with marked success. About 4000 shares of stock were bought by the company in the open market and sold to customers at $66 per share (par value, $50).

Public interest in the offering was raised to a high pitch by newspaper articles on the plan of the company and by the terms of the offer as explained in circulars sent to all customers. The result was that the 4000 shares were sold in two days after issue of the circulars and applications for more than 1000 shares additional were returned. The number of shares which any one person could buy was limited to five and the company increased its total of stockholders by about 1000.

JOINT SURVEY OF EXISTING POLE LINES

Co-operative Investigation by Engineers Representing Bureau of Standards and N. E. L. A. Committee on Safety Rules and Accident Prevention

A letter has been sent to member companies of the National Electric Light Association by William C. L. Eglin, chairman of the Committee on Safety Rules and Accident Prevention, calling to their attention the survey of existing pole lines throughout the United States and Canada, which the committee's engineers are conducting jointly with those of the Bureau of Standards.

The survey is being made to determine for future aërial line construction the effect of the loading requirements proposed in the new issue of the National Electrical Safety Code. Mr. Elgin states that the results may indicate that the present requirements as to loading are correct or that a revision upward or downward is desirable. The letter says:

It will be conducted, so far as possible, through the organizations of the geographic sections of the N. E. L. A., and it is expected that the work will be sufficiently well organized so that each company to be visited will be notified in advance. In some instances, however, this will be impossible and this notice is published in order that member companies will be prepared.

In general, heavy leads or lines built using long span construction will be most affected by the loading requirements of the code. These are the lines which it is intended to survey, but the performance of the construction studied must have been such that they can be considered as representing good modern practice.

The committee in charge of this work is especially anxious to coöperate to the fullest extent possible with the Bureau of Standards, and also to conserve the interests of the entire industry throughout the country.

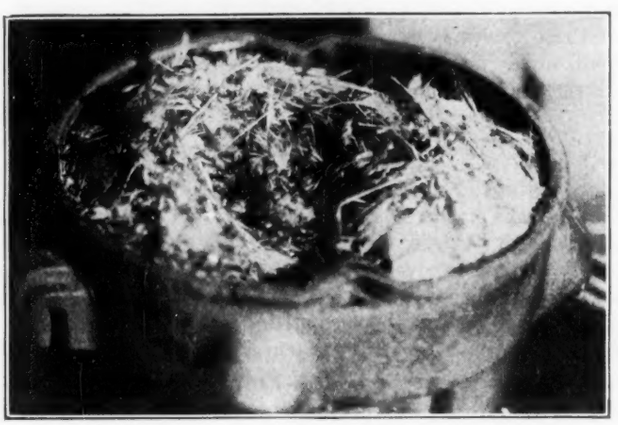
Therefore, each company is requested to give this question serious consideration, and be prepared to designate immediately the lines to be surveyed in order that all possible speed will be made and that the results will be such as to be indicative of actual conditions governing such work.

RECORD PEAK LOAD OF THE NEW YORK EDISON COMPANY

Sudden Storm with Daylight Darkness Sends Afternoon Demand from 250,000 hp. to 425,000 hp. and System Meets the Exigency

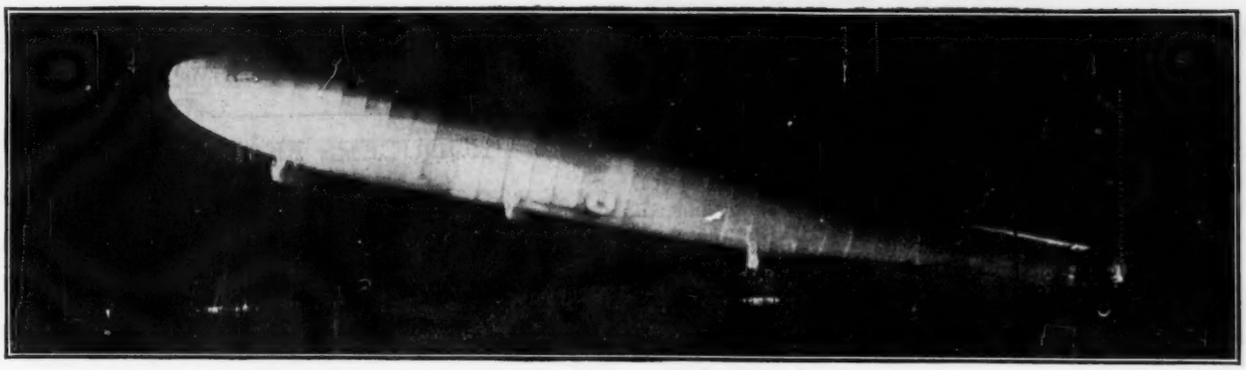
The New York Edison Company had to meet the largest demand in its history as a result of a sudden storm which struck Manhattan Island a little after 4 o'clock on the afternoon of June 20. A heavy fall of rain and the thunder storm brought the darkness of night to parts of the island. Shortly after the storm broke the stations, which had previously been generating about 250,000 hp., were called upon to supply a demand increased to 425,000 hp. The change in suddenness, percentage and magnitude was without precedent in the history of more than thirty years, yet every part of the system met the exigency without failure.

A Fatal Mistake



Results of a combination of a broken bushing and a persistent sparrow: The bushing dropped down, leaving a small opening between the lead and the case large enough for the sparrow to get through. The straw and feathers shown were found to be about 8 in. (10 cm.) in depth, resting on the terminal. There was no damage to the transformer, which was removed from service when it became overloaded. The sparrow, which may be seen by close inspection in the center of the nest, was found in the hole headed out, evidently having been finally electrocuted. This incident occurred on the lines of the Central Illinois Light Company at Peoria, Ill. The information and photograph were obtained from R. A. Keller, assistant superintendent of the electrical department.

The British Dirigible R-34 Anchored and Illuminated at Night



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The British dirigible R-34 was at Roosevelt Field, Mineola, Long Island, from the time of arrival in this country on the morning of July 6 until the return voyage was begun at midnight on Wednesday of this week. At night it was illuminated by searchlights. During its flight over Manhattan Island in the early hours of Thursday it was made visible to throngs of people by powerful searchlights. Notwithstanding severe static conditions the dirigible was in touch with wireless stations during the entire transatlantic voyage to this country. Communication was maintained with the stations at Clifden, Ireland, until Newfoundland was passed.

R. H. BALLARD ON INDUSTRY PROBLEMS

President of the N. E. L. A., Talking to Contractors and Dealers at Santa Cruz, Cal., Says Service is True Philosophy of Business

At a recent meeting of electrical contractors and dealers at Santa Cruz, Cal., President R. H. Ballard of the National Electric Light Association talked of some of the problems of the industry.

"To go forward both in thought and action and not dwell in the past is the real necessity of the times, particularly in the electrical industry," said Mr. Ballard. "We have gone through a very strenuous war period, and had many claims to meet in the way of Liberty Bond purchases, Red Cross subscriptions and other war donations, but, taking a broad view of things, it is plain that our country as a whole is in good shape right now. For instance, the banking power of the United States was at the close of the year 1918 two and one half times that of all countries engaged in the war, in 1890. Our savings per capita were in 1918 $113, as against $89 in 1914, and in addition to this our war savings were per capita $9.

"This is just about equal to the average increase in living expenses due to high prices, and with a continuance of the spirit of thrift and saving, prices will gradually come down as we reduce the inflation in our money, which is largely the cause of high prices. We should continue in thrift and economy, avoiding extravagance and waste, and in this connection should remember that thrift includes the continuance of production and useful expenditure. If with Mr. Micawber we are waiting for something to turn up, we are wasting time, and this is extravagant."

Mr. Ballard said that the National Electric Light Association is fully alive to the necessity for production and development and has a large program ahead of it for the next year. With its president located in California, and John A. Britton of San Francisco as chairman of the national public policy committee, the Pacific Coast has an opportunity to demonstrate what it can do in a national way, and will require the cordial coöperation of all in our industry.

"Have you tried," Mr. Ballard asked, "to find out what the association can do for you individually, in addition to its work for the industry at large? What can you do to benefit the industry by individual effort? Just what would you do working simply on your individual account to benefit the industry at large by the expenditure of $5 or $20 a year? But, taken collectively, if we have 15,000 individuals paying $5 in dues, if we have 5000 members paying $20, and 1200 central station companies paying their percentage of income, the result is a very considerable sum of money which can collectively be used for big things. In addition to this money item there is the time and expense so freely contributed by the big men of the industry.

"Let none of us be provincial. No man, no contractor, no company can singly do much, but collectively we can do a great deal.

"Many theorists and others are going over our country preaching radical changes in our national government. It is up to all of us to see that we are in no way led astray by these false teachers. Our present government has been proven the finest, the most democratic in the world, and by its very constitution it gives to us inalienable and inviolable rights of personal security, personal liberty and private property. No matter upon what pure theory some of these proposed new governments are based, their administration would be along the lines of the Bolsheviki in Russia, the Syndicalists and the I. W. W.'s of America, which are all one and the same thing in their utter disregard of personal security, personal liberty and rights of property. To what lengths have they gone in Russia in disregard of personal security and as to rights to property!

"We do not need a new government, but should get down to the true philosophy of business, that is, service. Not simply steady voltage and continuous supply, but a real, honest, earnest willingness to serve the public and give value received for all payment. Coupled with that we should so conduct our business that more customers would feel like the man in Mr. Kennedy's 'The Man in the Street,' that there is something in our service indefinable, which makes it a pleasure to do business with us, or, as another fellow said, 'Go 50-50 with our customers.'"

SYSTEM EXTENSIONS MADE IN DAYTON, OHIO

Record for the Year Is 70 Miles of High-Tension Transmission Line Construction—Purchase of Municipal Plants in Two Villages

During the last fiscal year the Dayton (O.) Power & Light Company has added materially to its transmission and distribution system. According to the report made to stockholders the company completed and placed in operation approximately 70 miles of high-tension transmission lines, radiating in various directions, principally north and south of the city of Dayton. The enlargement of the district covered by the company's transmission system made possible the acquisition of two additional municipal electric light plants, located in the village of Germantown, Montgomery County, Ohio, and in the village of Waynesville, Warren County, Ohio. Both were purchased during 1918.

While there was a reduction in the electric output of the company after the closing down of purely war activities in the Dayton territory, the officers of the company feel that the outlook for increasing the company's business for the year 1919 is very good. Careful estimates indicate that the fiscal year 1919 will show substantial growth in gross and net earnings.

In the report, which is signed by President F. M. Tait and Secretary O. E. Howland, the increase in kilowatt-hour sales in 1918 is given as approximately 30 per cent over 1917, resulting in a gain of 29 per cent in gross earnings and of 25 per cent in net earnings.

SHORT-COURSE INSTRUCTION FOR ELECTRIC METERMEN

Engineering Extension Department of Iowa State College, Ames, Will Expand Work Which Was Initially Undertaken Last Year for Utilities

To comply with the request of a number of electric companies in Iowa, the Engineering Extension Department of Iowa State College, Ames, conducted a practical short course for electric metermen for four days beginning Feb. 18, 1919. While this course was of special interest to the employees of those companies that do not find it possible to provide training for meter testers, it also proved of value to many others interested in testing, adjusting or installing electric meters.

The instruction was in the hands of practical men and consisted of lectures, demonstrations and laboratory work on single-phase, two-wire meters. The instruction was individual to the extent that each student had an opportunity to install, repair and adjust meters under supervision, and thus learn by actually doing the work himself. Displays of manufacturers' samples assisted materially.

For the coming year it is proposed to expand this instruction work to cover single-phase, two and three-wire meters, polyphase meters, demand meters, and advanced work in polyphase-meter maintenance and testing. The courses will vary in length and will be arranged so that any man may specialize in instruction according to his needs without taking work which he does not require. On the other hand, those who wish to do so may take the entire course of instruction outlined by the department.

While a definite date for the beginning of the course has not yet been set, the date will be arranged for the convenience of the students. The duration of the course will be from one to three weeks, depending upon the demand for instruction along the different lines mentioned.

COAL PRODUCERS FEAR COMPETITION OF FUEL OIL

National Coal Association Report Says American Producers Must Be Protected from Increasing Competition of Petroleum as Fuel

Threatened with demoralization of the coal market through the increasing use of Mexican petroleum as fuel, coal producers are preparing to fight for a protective tariff on imports of oil. C. E. Backus, chairman of the fuel oil committee of the National Coal Association, has issued a report pointing out the gravity of the situation from the standpoint of producers and urging that immediate steps be taken to avert the danger.

Several factors have combined to place Mexican oil in a favored position for fuel use, especially along the seaboard. These, says the report, are: Increased cost of coal production, due principally to higher wages and added cost of mine equipment; increased output from Mexican oil fields producing heavy oils which can be sold for steam purposes at low cost; increased number of tank steamers through release of those already built from war service and through building of more vessels, permitting the movement of a greater amount of oil from Mexican fields to the United States; and expected increase in production of Russian, Rumanian and other fields that may displace use of Mexican oil in Europe and so force a market for more Mexican petroleum in the United States.

Mr. Backus thinks that under present conditions the disadvantages of this competition far outweigh its advantages. He points out that with the existing rates of pay for coal mining, with existing prices for supplies, and with present rail freight rates, the producer of Mexican oil, dependent for his costs upon the single factor of water transportation, is in a position to undersell American coal operators. Foreign competition has become acute during the war, and the Mexican producer is now able to enter markets where he could not have obtained a footing on the pre-war costs of coal production and transportation.

Use of oil as fuel is rapidly increasing according to Mr. Backus. It appeals to many because of the comparatively simple apparatus needed for oil-burning engines. On the basis of four barrels of oil equaling one ton of coal, petroleum is in many cases much cheaper than coal. Fuel oil has been offered in New Orleans at around 85 cents a barrel, delivered f.o.b. cars, and at $1.15 a barrel delivered in tanks at individual consuming plants. Mr. Backus quotes a recent statement that, on a large contract with steady movement, Mexican oil would be delivered at Marcus Hook, near New York, at around 67 cents per barrel. One railroad which reaches tidewater in the South has secured bids on a long-term contract for oil delivered at its terminal at 61 cents per barrel. Present quotations on Atlantic and Gulf ports for four barrels of oil are not much more than the freight on a ton of coal to these points.

CONSTRUCTION WORK OF MONTANA POWER COMPANY

New Work Limited in 1918 to That Absolutely Necessary or Required for the War Program—Effect of Improvements in System

In his annual report to stockholders of the Montana Power Company, President John D. Ryan says that the policy during 1918 was to postpone, so far as possible, all construction not absolutely necessary, or which did not have as its aim the winning of the war. Aside from the completion of the Holter development and some substations and transmission lines under way at the beginning of the year, therefore, very little new construction was done.

Construction expenditures during the year amounted to approximately $750,000, covering the completion of the Holter plant, additions and extensions to transmission lines and local distributing systems, new substations and miscellaneous additions and improvements to generating stations, substations and steam heating departments.

Since the new plant at Holter was placed in commercial operation the operations, Mr. Ryan says, have been entirely satisfactory and indicate that the water wheels and generators are liberally designed; the actual capacity of this station proved to be in excess of 50,000 kw. instead of 40,000 kw. at which it was rated. The total cost of this development was approximately $3,800,000.

For the purpose of supplying the new Holter development with additional power outlet a new 100,000-volt standard bridge type underhung transmission line was constructed from Holter to the East Helena switching station, thirty-one miles. By means of a complete arrangement of air-brake switches this line affords duplicate service from Holter to the Butte and Great Falls Districts, and also a direct feeder line from Holter to the Milwaukee Railway at Josephine, and allows for many combinations of transmission in case of line trouble.

In order to care for the rapidly increasing demands at Conrad, which the existing steam and oil engine installation could not handle, a 50,000-volt single-pole transmission line was constructed from Choteau, thirty miles. A complete 300-kva., 50,000-volt substation was constructed at Conrad. By means of this new installation ample capacity was secured to care for the business at Conrad for some time to come and twenty-four hours' service can be given at a less cost than by enlargement of the old steam plant.

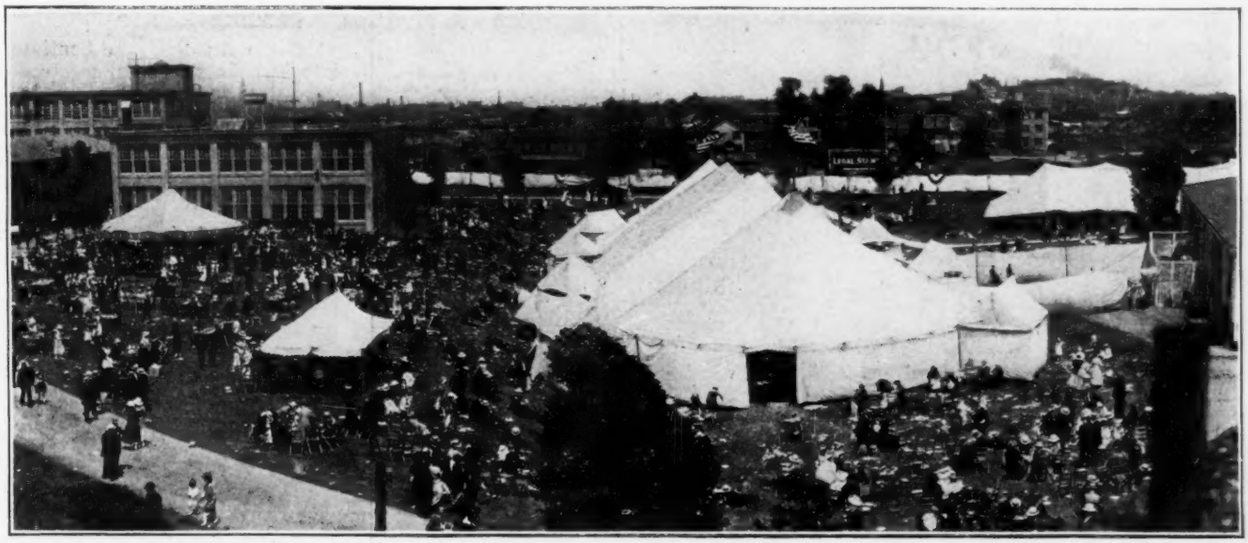
BRINGING THE PUBLIC AND COMPANIES TOGETHER

General Hearings by Connecticut Commission, Beginning at Bridgeport and Extending to Other Cities, Will Give Opportunities for Full Discussion

General hearings to bring the public into closer relations with the utilities serving them were scheduled by the Connecticut Public Utilities Commission to begin July 10 at the City Hall, Bridgeport. Subsequent hearings are planned at New Haven July 17, and at Waterbury July 24. These hearings represent a new departure in the practice of the commission.

The proceedings are to go beyond the sittings of the board in formal matters brought before it or as a result of informal proceedings by utility customers; they are designed to bring the public and the company representatives together before the commission and to afford full opportunity for the mutual discussion of any matters of interest which may be timely. The general improvement of service conditions and public relations is sought by this means. It is planned to give the public full opportunity on these occasions to bring before the companies and the commission any matters of service improvement or other topics for discussion which may profitably be considered. The hearings are to be conducted at other places in the state off and on during the coming twelve months, it is announced by the commission.

Field Day for Boston Edison Company's Employees and Their Families



Five thousand persons, including the President and Mrs. C. L. Edgar and many officers of the company, attended the field day held on Saturday, June 28, at the General Service Buildings, Boston, by the Edison Electric Illuminating Company of Boston, Mass., for its employees and for members of their families.

Doing It Electrically in the Movies

A film, "Which One of These Is You?" and six others prepared by the Society for Electrical Development, Inc., for use by electrical dealers in spreading the gospel of "Do It Electrically," were shown in the Bush Terminal Sales Building, New York, on June 27. In addition a film entitled "A Square Deal for His Wife," prepared by the Western Electric Company, to show the advantages of electric appliances for lightening labor in the home, was displayed.

RATE READJUSTMENT IN CALIFORNIA CASE

Commission Finds That Greater Precipitation Will Increase Hydro-electric Power, but That Wages Tend to Increase Still Further

A readjustment of the rates charged for electric energy by the Western States Gas & Electric Company has been ordered by the California Railroad Commission as a result of an investigation of the affairs of the company held by the commission in Eureka. The new rates, which are a combination of the old basic rate and the surcharge allowed to meet abnormal conditions, favor the consumer, the net result being a reduction of a half a cent a kilowatt-hour for lighting and about two mills a kilowatt-hour for power. In the opinion accompanying the order fixing the new rates, the commission says:

From the evidence introduced at the public hearing it appears that there has been a slight reduction in the cost of producing electric energy due to the fact that during the year 1919 the operation of the steam plant under the power administrator will in all probability be not required; also that there will be some additional hydro-electric power due to greater precipitation. A condition slightly offsetting this reduction in expense is the increase of 10 per cent in the cost of energy purchased from the Northern California Power Company. A large part of the increase which made necessary the surcharge is the cost of labor, which not only failed to decrease, but shows a tendency to further increase for the year 1919. There has been a slight reduction in cost of materials and supplies but not sufficient to result in a material change in the cost of operation.

The commission estimates that the new rates will yield a return of 4.29 per cent on an investment of $1,481,256. It is estimated that the rates will yield gross receipts of $239,283. The operating expenses have been estimated at $139,256, making the net from operation $100,027. Deducing $36,451 for depreciation gives a balance of $63,576 for return on the investment.

Under the new order the Humboldt Transit Company, which was paying for power 1.25 cents a kilowatt-hour, plus 2 mills surcharge, will pay 1.35 cents a kilowatt-hour. The Valdor Dredging Company, which has been getting power for seven-eighths of a cent a kilowatt-hour, plus a surcharge of 1 mill, will pay 9.75 mills.

LOWER ENERGY RATES ARE MADE FOR SMALL COMPANY

Connecticut Utility Must Reduce Charges for Lighting Service of All Classes. Rate-Making for Very Small Company Analyzed

The Woodbury (Ct.) Electric Company has been ordered by the Connecticut Public Utilities Commission to reduce its domestic lighting rates from 17 to 15 cents per kw.-hr. and its street lighting rate from 13 cents to 10 cents per kw.-hr., in a finding dated June 27.

The company is a very small property purchasing energy from the Connecticut Light & Power Company since Jan. 1 last, and distributing to local consumers over a system which the commission finds in need of much rehabilitation. War conditions and the unsatisfactory state of the distribution system have greatly handicapped the Woodbury company, which, however, has grounded its secondaries in response to the commission's former order.

Now that the war emergency is over, the board rules that the time has arrived for the company to repair and standardize its distribution system, pointing out that the establishment and maintenance of a utility is primarily for the benefit of the community served and that the expense of maintaining and supplying a utility rests ultimately upon the consumers. It is the company's duty, the decision states, to establish reasonable but sufficiently remunerative rates to meet its operating expenses, fixed charges, and allow a proper return on the capital honestly and wisely invested.

In determining the rates which the Woodbury company should charge the commission assumes that with a proper 24-hour service the consumption of energy by patrons of the company will average as much as that sold to the respondent during the first four months of 1919, or 17,500 kw.-hr. Allowing 10 per cent for loss, this would amount to an annual metered distribution of 47,520 kw.-hr. The commission says:

On account of the long hours and steady and continuous service for all-night lighting, the company can afford to establish a much lower rate for street or municipal lighting than for commercial or domestic purposes. While we do not find that $17 per annum per street lamp of 40 cp. for all-night service is unreasonable, we are of opinion and find that 13 cents per kw.-hr. is unreasonable, and it is also unreasonable to arbirtrarily dictate the candle-power that must be used therefor. The municipality should have not only the option of determining the number of street lights required but also the efficiency or candle power of such lights.

Assuming that the company should distribute and meter to its patrons 47,520 kw-hr. per annum, and assuming that one-third of said amount were used for street lighting and two-thirds for commercial or domestic purposes, and should receive 10 cents per kw.-hr. for the street lights and 15 cents per kw.-hr. for commercial and domestic purposes, the gross revenue of the company should be $6,336, out of which should be paid approximately $2,500 to the Connecticut Light & Power Company, leaving a balance of $3,836; other operating expenses, estimated at $2,000, leaving a balance of $1,836; and allowing 6 per cent on a $25,000 capitalization, or $1,500, would still leave a balance or surplus of $336. We believe that with the proper rendition of

service, the amount of energy annually required by the patrons will be considerably more than we have allowed on the foregoing figures, and that more than two-thirds will be distributed at the higher rates for domestic and commercial purposes. We are inclined at this time to allow the company a liberal rate in order that it may thereby be assisted in the rehabilitation of its plant.

A minimum charge of $1 per month is authorized for domestic and commercial lighting. A reasonable sliding scale of rates for power purposes must be established by the company whenever occasion therefor arises.

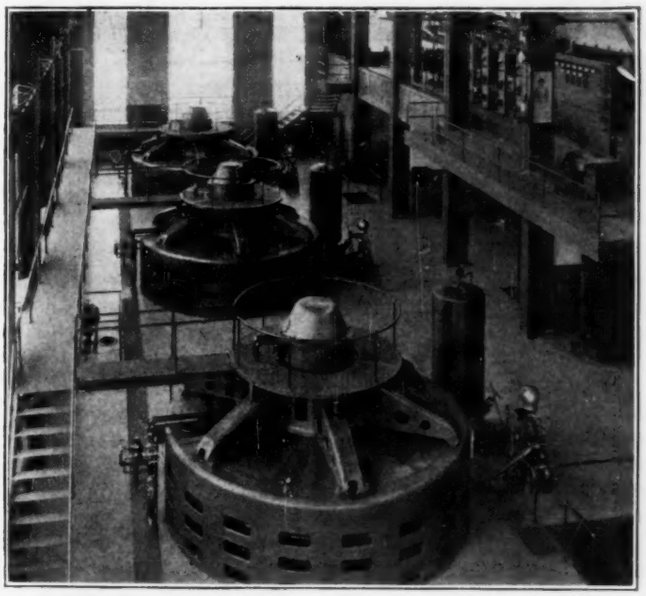
INTERCONNECTION BETWEEN ALBANY AND SYRACUSE

Effected Because of High Price of Labor and Fuel and to Make Best Possible Use of Water Power and Diversity Factor

Prior to the war the Adirondack Electric Power Company operated two separate divisions, one in the Hudson Valley between Albany and Lake George, including the city of Amsterdam, and another at Utica, supplying the electric railway service between Little Falls and Rome and the Oneida Railway as far west as Syracuse. The system was supplied entirely from the Utica steam plant, while the Hudson Valley system was supplied almost entirely from a water-power plant. Owing to the high cost of fuel and labor, it became imperative during the last year of the war to connect these two divisions so that the best possible use could be made of the water power and advantage taken of the diversity factor. Accordingly a 45-mile (72-km.) line was constructed between Amsterdam and Little Falls and is now operating at 60,000 volts. (See ELECTRICAL WORLD, May 17, page 999.). The Hudson Valley division of this company has a high-tension system operating at 30,000 volts, and step-up transformers were installed at Amsterdam to connect with this line. Between Little Falls and Utica the 17,000-volt line of the New York Railways, which is leased to the Adirondack Electric Power Corporation, was reconstructed for 60,000 volts, as were also the substations at Little Falls, Mohawk and Frankfort. Both systems were operating at 40 cycles so no excepticnal difficulties were encountered when the systems were paralleled.

The distribution systems in Oneida and Canastota have been receiving energies from the high-tension line of the Oneida Railway, which in turn is supplied at Clark Mills by the Adirondack company. In order to give better service to this place a 60,000-volt line is being built between Clark Mills and Oneida, a distance of about 14 miles (22 km.). This circuit is of aluminum steel, having 300-ft. (27-m.) spans.

One extension to the United States Arsenal at Watervliet was directly due to the war. This was formerly supplied from the regular 2300-volt system in that place, but with the increase in load it became necessary to provide additional capacity. Despite the severe weather of the spring of 1918, an 11,000-volt line was run to the arsenal, where an outdoor substation was constructed. Another 11,000-volt circuit was also installed between the Watervliet substation and the plant of the Ludlum Steel Company, which was making large quantities of steel for the government. An addition to the Watervliet substation has been made and a 75,000-kva. synchronous condenser will be installed shortly. While this installation was decided upon from a purely economic viewpoint the work thereon was hastened by the war-time activities.



NEW STEAM AND HYDROELECTRIC STATIONS AT UTICA AND COHOES (N. Y.) RESPECTIVELY

Extensions to the steam and hydroelectric stations of the Utica Gas & Electric Company and the connection of these two stations by a 44,000-volt transmission line constitute the chief step which that company has taken to handle its increased loads. The steam plant addition involved the installation of a 5000-kw. turbo-generator and complementary equipment and a large outdoor transforming and switching house. At the water-power plant three 8000-kva. water-driven generators are being installed to operate on a head of 225 ft.

A new steam generating station with an installed generating capacity of 15,000 kva. and a future capacity of 60,000 kva. have been put in service at Albany and will be connected with the 27,000-kva. hydroelectric station of the Cohoes company by a 30,000-kva. tie-line.

WATER POWER BILL IS PASSED BY THE HOUSE

In Substantially the Same Form as That Passed by House at Last Session—Now Before Senate Commerce Committee

The House of Representatives has now passed the water power bill. This took place shortly after the Washigton representative of the ELECTRICAL WORLD reported that the bill had become entangled in a series of conference reports which might prevent its immediate passage. The bill is substantially the same as the measure which was passed by the House of Representatives at the last session of Congress. No important amendments were made.

The measure is now before the commerce committee of the Senate, and will be taken up by a sub-committee of that body shortly after Aug. 1, when Senator Jones of Washington, chairman of the committee, is expected to return from a visit he is now making to Seattle. The other members of the sub-committees who will have jurisdiction over the bill for the time being are Senators Nelson, Lenroot, Bankhead and Fletcher.

Friends of water power legislation in Washington now predict the early passage of the bill by the Senate, but in legislative circles at the capitol it is well understood that questions of foreign affairs relating to the peace treaty and league of nations will have an important effect upon the early passage of any legislation.

THE BRITISH HOME OFFICE DISCUSSES ELECTRICITY BILL

Its Financial Conditions Are the Subject of Controversy—Herbert N. Casson Writes Racily on the Situation

According to contemporaries in London, when the financial sections of the electricity supply bill were considered by the House of Commons some objection was raised to the provision for advancing up to £20,000,000 in connection with the construction of interim works and the guaranty of interest on the stock issued under the act up to £25,000,000. It was pointed out to the government that for the first financial year the probable expenditure would be £1,035,000, but that it was impossible to state what amount of interest would be guaranteed by the Treasury, although it could not be the maximum of £25,000,000.

The Home Office has issued a memorandum on expenditure likely to be incurred under the financial sections. It is stated that the whole of the expenses in connection with the administration of the bill will ultimately be borne by the district electricity boards. During the first five years after passage of the act the expenses will be paid out of the moneys provided by Parliament, but such moneys are to be treated as advances and are to be repaid with interest. Salaries, office and traveling expenses of the electricity commissioners, their inspectors, assistants and staff should not exceed £35,000 per annum. It is thought that expenditures on necessary experiments for the improvement of the methods of electricity supply will not exceed £10,000 a year. This money will be recovered from the industry in the same way, and there will be no permanent charge upon the state.

The memorandum also states that the expenditure on urgent works not exceeding £20,000,000 will be an advance from the Treasury and will be repaid with interest and such charges as the Treasury may require by the district electricity boards. These expenditures will be spread over five years as follows: Year ending April 1, 1920, £1,000,000; 1921, £3,000,000; 1922, £7,500,000; 1923, £5,000,000 and 1924, £3,500,000. This estimate is based on the known urgent requirements for new generating stations and plants and is spread over the time necessary to cover the constructional period. It also covers necessary transmission and interconnecting cables and lines, having regard to the annual output from and capacity of British cable makers' works.

In regard to the clause permitting the Treasury to guarantee interest not exceeding £25,000,000 of stock, the memorandum says that it is impossible to say in what cases, if any, payments will have to be made on this guarantee. The whole scheme is based upon the anticipation that under the plan the industry will be self-supporting.

PRIVATE MANAGEMENT WITH GOVERNMENT CONTROL, SAYS OBSERVER

An article written for the Boston News Bureau from London by Herbert N. Casson says in part in regard to the new electricity supply bill:

At last we know what the policy of the British government is to be regarding big business. The new "electricity supply bill," with its forty-five clauses, tells the story very plainly. There has been a great deal of vague talk and many threats of national ownership, but this electricity supply bill at last gives us the details. Now we know the worst.

There will be no national ownership. Neither will there be private ownership, in the ordinary sense. There will be private management with national control.

The government has determined to depend on the good old English principle of compromise. It is going to mix a glass of half-and-half. It will follow its historic method of being moderate, of playing safe, of tempering the wind to the shorn lambs. It will avoid the rocks of revolution and the deep waters of reconstruction. It will follow the coast line of public opinion, dodging in and out and around promontories in the good old-fashioned English way. It will do nothing drastic, nothing brilliant, nothing logical. It will do nothing that is either efficient or dangerous.

The English, who are the exact antithesis of the Irish, know that in the long run the tortoise wins the race, because the hare runs hither and thither and makes very little speed net. Consequently this new electricity supply bill is a tortoise bill. It proposes to go slowly—to satisfy everybody partially and to satisfy nobody completely.

The clause which deals with the limitation of prices and profits is very vague and nebulous.

So there will be no national development on national lines. There will be a number of local monopolies, under state regulation. There will be no standardization. The type of current, the frequency and the pressure will still vary in different districts. There may still be twenty-one different electrical plants in London but managed by one board. The only thing that is completely abolished is competition. Of that there will be none. It will be as illegal as counterfeiting. In short, the government has taken as its ideal the "Port of London Authority"—a patchwork organization which was established ten years ago to manage the London docks. This body consists of twenty-nine members. Ten are appointed by various government bodies; eighteen are elected by dock owners and ship owners, and a chairman is chosen from outside by the authority itself. The present chairman is Lord Devonport, who was in his pre-lord days a grocer.

This Port of London Authority has done fairly well. It has increased its charges 65 per cent during the war, and it has had plenty of troubles. It has prevented the chaos

of individualism on the one hand and the efficiency of skilled management on the other. But it is unquestionably the type of organization that best suits the English policy and the English temperament.

GOVERNMENT PLANS RADIO STATIONS TO GUIDE AIRMEN

Centers Will Be Established to Direct Air Mail—Three Contracts Already Let, and One Station Will Be Completed in October

To enable airplanes, especially those carrying mail, to find their direction in times of fog, the government plans the erection of a chain of high-powered radio stations in the principal cities along the proposed air routes. Emil J. Simon, manufacturer of radio apparatus for the War and Navy Departments, announced this week that the Post Office Department at Washington had already contracted for the first three stations, which will be established at Bellefonte, Pa., Cleveland, Ohio, and at a point somewhere on Long Island or at Newark, N. J.

Appropriations for these stations are already available, and other contracts will be let as soon as Congress provides the necessary funds. Construction is to begin at once, and it is expected that the Bellefonte station will be completed by the middle of October, while the other two will probably be ready for operation early in December.

Each of the stations will be equipped with steel towers 200 ft. (60 m.) high and 300 ft. (91 m.) apart and will have a range of approximately 400 miles (643 km.) to mail airplanes and approximately 700 miles (1126 km.) between stations.

HEARINGS ON PATENT BILLS AT WASHINGTON

Frederick P. Fish, Appearing Before Committee on Patents of House of Representatives, Urges Separation of Patent Office from Department of Interior

The House committee on patents began public hearings on July 9 on three bills relating to the Patent Office. One of these bills proposes to establish a United States Court of Appeals. The second bill would reorganize the Patent Office, remove it from the control of the Department of the Interior, and create an independent bureau to be known as the Patent and Trade Mark Office. The third measure proposes to revise the salaries and create additional department heads in the patent service. All three measures are fostered by the National Research Council.

One of the first to testify before the committee, of which Representative Nolan is chairman, was Frederick P. Fish, of Boston, who urged the separation of the Patent Office from the Department of the Interior. Many other patent attorneys and other experts are expected to present arguments to the committee and the presentation of arguments has been placed in the hands of Mr. Prindell, Secretary of the National Research Council.

It is understood that the committee is willing to hear anyone interested, and that the committee reserves to itself the right to amend the bills which were drawn by the National Research Council.

PLANS FOR ILLUMINATING SOCIETY CONVENTION

Chicago Convention Committee Expects Attendance of 450 at Fall Meeting, Date of Which Is to Coincide with the Chicago Electric Show

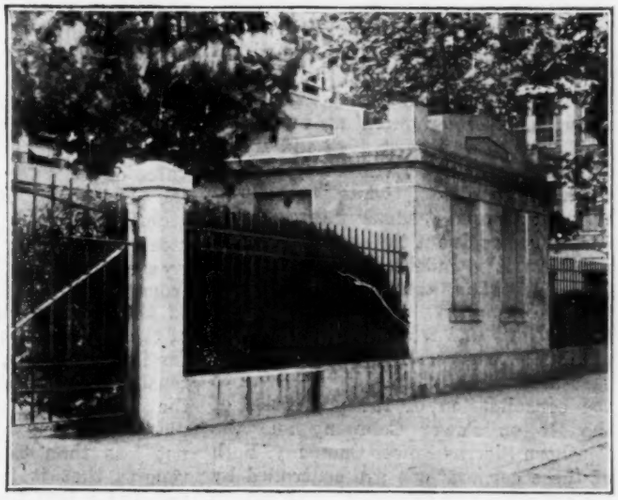
The 1919 general convention committee of the Illuminating Engineering Society, of which Homer E. Niesz of the Commonwealth Edison Company is chairman, held its first meeeting July 1, to plan for the convention of the Illuminating Engineering Society which is to be held in Chicago, Oct. 20, 21, 22, and 23. It was the opinion of the committee that entertainment this year should play a particularly important part in the convention.

This it is hoped will assist in cementing the personal friendships in the lighting branch of the industry which go so far to make more successful cooperation within the industry. R. S. Schuchardt, chairman of the sub-committee on entertainment, has suggested a novel plan which will carry not only effective entertainment, but will also provide an undercurrent of thought on better lighting throughout the entire convention.

Considerable interest was shown in the text of the papers which were to be presented, and it is probable that these will cover a broader field of topics than those which have been prepared for any former convention. It is the hope that these papers will cover topics interesting to the lighting men of central stations, large manufacturing companies, fixture and accessory manufacturers, engineers, jobbers, retailers, contractors and electric shop representatives, consulting and illuminating engineers and lighting specialists and physicists.

Attention was also given to the subject of securing proper representation and assistance from the gas-lighting industry.

An Artistic Substation



This industrial substation of the American Bosch Magneto Corporation at Springfield, Mass., is located at the front of the yard, bordering on the property line and architecturally harmonious with the reinforced-concrete factory building. Service is supplied by the underground cables of the United Electric Light Company, Springfield, Mass. The meters and the 500 kva. transformer installation are housed in the substation.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Inefficient Service and Higher Rates.—In allowing increased rates for the Golden City Electric Light Company the Missouri Public Service Commission decided that evidence as to inefficient electric service, not urgently pressed, with reference to minor defects of a small electric utility—momentary dimness of lights and failure to supply energy early enough on dark evenings—requiring an impracticable expenditure for the installation of rectifying machinery in view of the small revenue derived from the service, is not sufficient to stay a proposed increase in rates, in themselves not yielding a fair return, to a utility not earning operating expenses. It was also held that a small electric utility furnishing direct-current service to consumers on a flat and meter rate basis is not required to install an all-metered service, as direct-current meters are not so satisfactory as alternating-current meters and the high cost of installation would impose an unnecessary burden upon the company which would eventually fall upon the consumers.

Consolidation of Properties Suggested.—Consenting to the issuance by the Holton Power Company of $50,000 of the company's first and refunding 6 per cent bonds, the California Railroad Commission directs that the bonds shall be sold for not less than 85 per cent of their face value, plus accrued interest, turning down the company's request that it be allowed to sell the bonds at 80 (the price asked for a previous issue) on the ground "that the company is no longer operating under the conditions prevailing in 1912 and 1914." In a further review of the company, the commission says: "It has been shown that the company, under intercompany accounts, has due it the sum of $137,931 and that it is indebted in the sum of $551,553. The commission suggests that the company endeavor to collect the moneys due it and reduce its current indebtedness. It further suggests that serious consideration be given to the consolidation of the properties of the Holton Power Company and the Southern Sierras Power Company. Both of these corporations are controlled by the same holding company. The reason for continuing a separate corporation to conduct a portion of the electrical business in the Imperial Valley is not apparent. It occurs to us that it is to the interest of the consumer as well as of the investors in this property to conduct its operations in the most economical manner, and that this can be done only by eliminating unnecessary overhead and other expenses in connection with the maintenance of a corporate organization for which there is no apparent necessity."

Rate Increase in Illinois.—The Illinois Public Utilities Commission has authorized the Cullom (Ill.) Electric Company to increase rates. The top step of the schedule is 16 cents per kilowatt-hour, net, with a $1 minimum bill.

Price for Stock.—The California Railroad Commission has approved the application of the Pacific Gas & Electric Company for an order authorizing the issue of $3,500,000 of its first preferred 6 per cent stock. The order was issued after a hearing before Commissioner Frank R. Devlin, at which A. F. Hockenbeamer, second vice-president and treasurer of the Pacific company testified that the company has received a definite offer for that amount of stock. The stock is to be sold at not less than $85 a share.

Service for Irrigation Pumps Endangering Water Power.—The California-Oregon Power Company has been ordered by the California Railroad Commission to begin immediately the construction of a line to carry electrical energy to operate irrigation pumps to the ranch of Webb Brothers Company in Siskiyou County. The Webbs are to advance the cost of the construction, the company to pay 7 per cent interest upon the amount advanced if the payment for the energy supplied falls below $250 a year. The utility opposed the giving of service on the ground that it was the intent of the Webbs to pump water from the Shasta River, thus endangering the utility's water supply for power development purposes. The commission did not go into the dispute over water rights, the evidence showing that it was the intention of the power company to take the matter into court in an effort to prevent the Webbs from using the water.

Selling Price of Bonds.—Authorizing the San Diego Consolidated Gas & Electric Company to issue $107,000 of its first mortgage 5 per cent bonds, due March 1, 1939, and $226,900 par value of its 7 per cent preferred stock, the California Railroad Commission stipulates that of the proceeds of the stock sale $86,000 may be used to increase the company's working capital from $300,000 to $386,000. The balance of the funds resulting from the sale of the stock and the bonds is to be used for improvements, betterments and extensions. In authorizing the bond issue the commission took exception to the plan of the company to sell its bonds at not less than 82. "A company that reports that it is earning more than two and a half times its bond interest, which has regularly paid a 7 per cent dividend on its preferred stock and has paid 10 per cent dividends on its common stock, should be able to sell its bonds on at a 6 per cent basis, or for not less than 88," says the commission in the opinion accompanying the order of authorization.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 927 of this number.

N. E. L. A., Michigan Section.—This section will hold its annual convention at Hotel Ottawa, Ottawa Beach, Mich., on August 19 to 21 inclusive.

A. I. E. E., Panama Section.—The August meeting will take the form of an informal cotillion for the purpose of stimulating the social life of the section.

Empire State Gas & Electric Association.—At the meeting of the executive committee on June 20 it was voted to hold the annual association meeting in New York City on Oct. 9.

Electric Club of Chicago.—Major D. J. O'Connor explained the efficiency of the personnel work of the Army at the last meeting of the season, June 12. The club will hold its annual outing at Ravina Park on Aug. 21.

A. I. E. E., Philadelphia Section.—The officers for the ensuing year are: C. E. Clewell, chairman; Nathan Hayward and W. S. James, past chairmen; Harold Pender, vice-president, A. I. E. E.; L. J. Costa, P. H. Chase, N. E. Funk, Baxter Reynolds and E. B. Tuttle.

Joint Meeting of Portland Sections, A. I. E. E. and N. E. L. A.—At the last meeting for the firscal year, held at the University Club, Tuesday, June 10, Capt. E. F. Whitney gave a talk on the flash and sound method of range finding. Captain Pearson and Lieutenant Roberts also spoke.

Electric Hoist Manufacturers' Association.—The regular monthly meeting was held on June 27 in New York City. The engineering committee has prepared a booklet on "Facts for Operators of Electric Hoists," which may be had on application to the secretary, W. C. Briggs, 30 Church St., New York.

A. I. E. E., Portland, Ore.—The officers just elected for the ensuing year by the Portland Section of the American Institute of Electrical Engineers are W. D. Scott, Pacific Telephone and Telegraph Company, chairman, and E. H. Le Tourneau, Portland Railway, Light and Power Company, secretary-treasurer.

United States Independent Telephone Association—At the fourth annual convention of the association held in Chicago June 24 to 26 inclusive, the following officers were elected: President, Fred B. MacKinnon, Washington, D. C.; vice-presidents, Frank Beam, Columbus, Ohio; J. B. Barle, Waco, Texas, and W. F. Goodrich, LaCrosse, Wis.; secretary-treasurer, W. S. Vivian, Chicago; chairman of the board, E. B. Fisher, Grand Rapids, Mich.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Change in Regulations of Patent Office.—The practice of keeping alive applications for patents without taking them out is curtailed by a recent ruling of the United States Commissioner of Patents. Under the new regulations an inventor is notified at the end of three years after filing that the application has been placed in the "preferred" class, and he is asked to take prompt action to carry the case through as quickly as possible.

To Investigate India's Water Powers.—The government of India has appointed G. T. Barlow, chief engineer for irrigation of the United Provinces, and J. Mears, electrical adviser to the Indian government, to inquire into the country's water-power potentialities. They will personally inspect water-power sites and decide which ones are worthy of detailed investigation. This will be the first step in a thorough hydrographic survey in preparation for the eventual development of India's power resources to their fullest extent. The supply of coal is limited, and in view of the great industrial expansion expected in the next few years the investigation of alternative sources of energy has become a question of national importance.

Canada's Vast Water Powers.—Sir Robert Borden, the Premier of Canada, in a statement dealing with the natural resources, of the Dominion, emphasizes the great source of potential energy in the form of water power. On the River St. Lawrence alone, between Lake Ontario and Montreal, he estimates that Canada has the opportunity of developing 2,500,000 hp. The Premier's statement says in part: "This asset has already been considerably devolped, especially in the provinces of Ontario and Quebec. It lends itself to the development not only of manufacturing industries but of agriculture. Conducted to the rural districts by great distributing lines, it is employed on the farms in many useful services. The opportunity which it gives for industrial development is almost beyond imagination."

Opportunity in Seattle Project.—Seattle should immediately begin construction of the first unit of the Skagit project, according to J. D. Ross, superintendent of the city's municipal power plants. The present industrial outlook in the Northwest, in his opinion, justifies the city in preparing for the eventual development of 450,000 hp. By the time the first unit of the Skagit project, which Mr. Ross considers the greatest opportunity in the Northwest, is completed, a market will have been found for the power and the second unit will be needed also. Immediate construction is necessary, he feels, because if private interests get control of the Skagit power the Seattle municipal plants would be forced to close owing to inability to compete. The present cost of energy per kilowatt-hour at the company's Cedar River (hydroelectric) plant is 3.47 mills, and at the Lake Union (steam) plant 12.97 mills. Operating the two plants as one unit, the average cost of energy produced by the company's plants is 5.61 mills. The cost of producing energy in the first unit of the Skagit plant, taking into consideration conditions under which the present plants operate, is estimated at 2.67 mills. This shows the cost of producing energy to be nearly 3 mills below the cost of energy produced by the combined steam and Cedar River plants. Superintendent Ross declares that the cost of fuel oil alone at the steam plant will more than pay the cost of operation of the Skagit plant for a year, including interest and depreciation.

Appropriation for Forest Products Laboratory.—The Forest Products Laboratory of Madison, Wis., is faced with the prospect of very materially curtailing its activity. At a recent meeting of the Chicago Association of Commerce, and the executives of the United States Forest Products Laboratory at Chicago, Mr. Winslow, director of the laboratory, stated that prior to the war the laboratory had an annual appropriation from Congress of $140,000, and employed something over eighty people. During the war this appropriation was supplemented by allowances made by the war and navy departments aggregating during the year 1918 over $700,000. The number of people employed reached a total figure above 500. The money furnished by the war and navy departments was to cover certain specific investigations and these were not as greatly beneficial to trade in general as those which were carried on on the appropriation of $140,000. At present a bill has passed both the House and Senate which appropriates $175,000 for the current year. This is, of course, insufficient to maintain the present organization. In addition to this the laboratory is at the present time occupying buildings loaned by the State of Wisconsin, and certain of these buildings will very shortly be needed by the University of Wisconsin, so that more space will probably be necessary. It is claimed that the laboratory needs approximately $300,000 as its appropriation to carry on the necessary industrial investigation, and that it will ultimately need an appropriation of not less than $500,000 for a permanent home. Quite a number of industries are interested in securing the appropriation, and it has been suggested that the laboratory may be relocated in Chicago.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Revocation by City of Right to Use Streets.—Where an electric light and power company occupied city streets with its poles and wires prior to the adoption of the Burlington revised city charter, giving the city the right to fix conditions and regulations for use or occupancy of streets by electric power and lighting companies, the Supreme Court of Vermont has held that the right so given the city by the Legislature did not affect the vested right of such company to occupancy of street and did not authorize city by a subsequent ordinance to revoke or infringe that right (106 A. 513).

Writ of Certiorari Denied by Supreme Court.—The United States Supreme Court has denied the petition of the City of Omaha for a writ of certiorari to bring before it the case of the Omaha Electric Light & Power Company vs. the city of Omaha and Michael J. Curran. The company brought suit in the Federal District Court to enjoin the city from enforcing a municipal ordinance passed in 1914 whereby the plaintiff was denied use of the streets and other public places for the transmission of current for power or heating purposes. The District Court held against the contentions of the city and entered a decree perpetually enjoining the enforcement of the ordinance, holding that the company's franchise entitled it to use the city streets for power transmission. The Circuit Court of Appeals affirmed the decree.

Highway Crossing Accidents.—The Supreme Court of Appeals of West Virginia has held (99 S.E. 180) that if the operator of an interurban electric car negligently failed to discover plaintiff's approach to a railroad crossing over a public highway, though the driver duly gave proper warning of the car's approach thereto and otherwise performed such other duties as the law required at such crossings, and plaintiff also negligently failed to stop, look and listen for such car, although he knew one was then due and the direction from which it would come, and although warned by another person similarly situated of the car's approach, there being no obstruction seriously affecting the view of the track, and by him requested not to enter upon the crossing because of the apparent danger of doing so, and, although possessed of such knowledge and so warned, plaintiff did drive his automobile thereon, whereby it was injured, such negligence, contributing thereto, precludes the right to recover for the injury so sustained.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

George H. Wygant, for the last nine and a half years commercial agent of the Tampa (Fla.) Electric Company, has been transferred by Stone & Webster to Baton Rouge, La., as manager of the Baton Rouge Electric Company, which furnishes gas and electric light and power service, as well as electric railway transportation, to that community.

Charles G. Du Bois, who was elected president of the Western Electric Company on July 1, 1919, succeeds H. B. Thayer, who has resigned after 38 years of service to assume the presidency of the American Telephone and Telegraph Company. Mr. Du Bois was born in 1870. After his graduation from Dartmouth College in 1891, he joined the Western Electric Company in New York, as a clerk in the accounting department, and in 1896 he was appointed chief clerk at the New York office. In 1898 he was elected secretary of the company with offices at Chicago. This work carried with it a general supervision of the entire accounting system of the Western Electric Company; and in this connection Mr. Du Bois was largely instrumental in working out and securing the adoption of the company's first pension plan. Shortly after assuming the duties of secretary, Mr. Du Bois was also made supervisor of

C. G. DU BOIS

the company's branch houses. This carried with it the opening of a large number of distributing houses, which are now a part of the Western Electric organization. In 1907 Mr. Du Bois was transferred from the Western Electric Company to the American Telephone and Telegraph Company as its comptroller. In that capacity he inaugurated and supervised a new comprehensive system of accounting for the Bell Telephone System. In 1917, shortly after the entry of the United States into the war, he went to Washington to serve as comptroller for the American Red Cross. After systematizing the Red Cross accounting work and organizing a department to carry it on, he resumed his duties with the company. On October 1, 1918, he re-joined the forces of the Western Electric Company as vice-president, which office he held until his election to presidency.

J. P. Ingle, manager, Keokuk (Iowa) Electric Company, has been elected president of the Iowa Electric Railway Association for the ensuing year and a member of the board of directors for five years. Mr. Ingle before going to Keokuk in 1908 was identified with the public utility companies of Atlanta and Columbus, Ga., and Baton Rouge, La. Since 1915 he has been manager of the Keokuk Electric Company which serves several surrounding towns in Iowa and Illinois.

William von Phul, who has been vice-president and general manager of the United Railroads of San Francisco since 1916, has been elected president and general manager of the company, succeeding as president the late Jesse W. Lilienthal. Mr. von Phul was employed at one time as general superintendent of the Louisiana Electric Light Company and of the Edison Electric Company, New Orleans, until 1902, when he became associated with Sargent & Lundy, engineers of Chicago. He represented that firm as engineer in charge of construction for the Cincinnati Gas & Electric Company, later becoming general superintendent. In 1905 he accepted a position with Ford, Bacon & Davis and since 1907 assisted in the firm's engineering and operation of the street railway and lighting companies in a number of large Southern citites comprised in the American Cities Company, including the Birmingham Railway, Light & Power Company, Memphis Street Railway, Nashville Railway & Light Company, Little Rock Railway & Electric Company, Houston Lighting & Power Company and later the New Orleans Railway & Light Company. In 1912 he became a member of the firm of Ford, Bacon Davis and four years later he was selected to take over the management of the affairs of the United Railways.

J. M. Scott, president-elect of the Missouri Public Utilities Association, is a Canadian by birth and received his education at Queen's University, Kingston, Ont., but he has since resided continuously in the United States. During the early inter-connection and development period of the Westchester (N. Y.) Lighting Company he was employed in commercial worked by that concern. Later he became a traveling auditor for the United Gas Improvement Company of Philadelphia. This position he held until he was made secretary-treasurer and a director of the Kansas

J. M. SCOTT

City (Mo.) Gas Company, one of the subsidiaries of the United Gas Improvement Company.

Obituary

George Lockwood, of Providence, R. I., one of the general managers of the National Lamp Works of General Electric Company, died suddenly in a hospital on Association Island, June 26, following an operation for appendicitis. Mr. Lockwood was 47 years of age. He was born in Newark, N. J., and was a graduate of the Stevens Polytechnic Insititute. Through his connection with Stevens Institute he became associated with John W. Howell, chief engineer of the Edison Lamp Works, about 1890. For about four years he devoted himself to the manufacturing end of the lamp business, but subsequently engaged in the commercial end of the business in which he continued until the year 1898, when he was employed to operate the factory of the Sunbeam Incandescent Lamp Company at Desplaines, Ill. In 1901 the Sunbeam company, assisted by B. G. Tremaine, inaugurated the first activity which resulted in the formation of the National Electric Lamp Association, which subsequently was incorporated as the National Electric Lamp Company and finally merged with the General Electric Company. Throughout the entire period of development Mr. Lockwood was active in creating and developing several branches of the National company into sound business divisions, applying himself both to manufacturing and commercial problems. At the time of his death he was general manager of the Bryan-Marsh Division. The loss of Mr. Lockwood will be most keenly felt by the National Lamp Works, not only because of his ability to operate and manage a large and important branch of its business, but because of the great love and esteem held for him.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

MOTOR DISCOUNTS AGAIN UP FOR DISCUSSION

However, More Than One Hundred Manufacturers Disinclined to Change From Present 200 Hp. Limit

Motor discounts to dealers have been under discussion for some time as has been noted repeatedly in these columns. Only a few days ago at the Santa Cruz, Cal., convention the matter came up again. The dealers are strongly urging that the discount limit be raised considerably above the present 200 hp. It looks as though the larger manufacturers are strongly in favor of raising the limit to 1000 or preferably 5000 hp.

It appears, however, that there are one hundred and thirty-eight motor manufacturers of whom over one hundred are unwilling to change the present 200 hp. discount limit because it would shut them out of a considerable amount of business that they now get.

1919 EXPECTED TO BE A $16,000,000 FAN YEAR

Early June Hot Spell Brings Shortages Weeks Before Season Ordinarily Begins—Large Sizes Sell Best

All signs point to 1919 as the banner electric fan year. Even now, three weeks in advance of the normal big fan movement, the sales in a number of places equal those of the entire 1918 season.

Provided the sales for the remainder of the year live up to expectations it is estimated that 1919 fan sales will reach a total of 900,000 fans with a total value of $16,000,000. These estimates were conservatively made and will certainly not err on the side of being too large.

This year fan weather came in with Memorial Day and continued right along in the Middle West but lasted only a couple of weeks in the East. The North West has never been a large purchaser of fans because of the shortness of the hot season. Only enough fans are stocked by jobbers to last a very few days.

Shortages began to develop within 10 days after the heat wave started. At the first the 16-in. fan was the most popular. The small sizes of 10-in. and under did not begin to develop a brisk demand until more recently. As has been found in the last two years the oscillating fan is finding a readier market than the non-oscillating type in all sizes. There appears to be some difficulty in moving the very small fans this year. Department stores, it was noticed, after the first week began to offer small size fans at considerable reductions.

With only three sizes on the market this year, large, medium and small, the large seems to be going best, the medium next and the small last. In some cases where the supply of the larger sizes had run out purchasers had to be content with the small fans.

Since the first buying rush stocks have been gradually replenished and at this writing jobbers are on the whole in a pretty satisfactory condition to take care of a heavy buying movement.

Ceiling fans have sold far better this year than last. The same is true of 32-volt outfits.

A very small household market has developed this year and as would be expected from the sale of the large types the buying has come almost altogether from commercial establishments and industries. In the latter instance the contentment of labor has been found to be a factor in the fan market.

The export demand has been large this year. During the first four months of the current year 33,506 fans valued at $631,571 were exported. During March alone 14,479 fans valued at $269,934 were exported. This is the largest amount of fans ever exported from the United States in any one month.

AUSTRALIA PUTS PROHIBITION ON RUBBER-COVERED WIRE IMPORTS

Must Comply With Certain Specifications and Conditions—All Wire to Be Labeled With Manufacturer's Data

The Australian government has prohibited the importation of rubber-covered wire as of July 1, unless it complies with certain specifications and conditions. Each coil of wire must be labeled with the manufacturer's name and address, length of wire in the coil, date of manufacture, size of conductors and the insulation resistance. Certain tests are required. British wire manufacturers are using their C. M. A. (British Cable Makers Association) tags. While this action is publicly reported to have been taken because wire from a certain country (not stated) was unreliable and was too much of a fire risk, still it is well known that English cable manufacturers have made strong representation in the Australian and New Zealand markets to prevent the use of any but C. M. A. wire.

The Australian imports of insulated wire and cable manufactured in the United States have been as follows for the fiscal years ended June 30, 1914, $121,181; 1915,, $64,304; 1916, $66,360; 1917, $72,860; 1918, $203,164; for New Zealand: 1914, $1096; 1915, $1259; 1916, $2028; 1917, $59,364; 1918, $2514.

During the first four months of the current calendar year the American exports of insulated wire and cable to Australia were—January, $56,318; February, $2524; March, $13,304 and April, $5046, or at the rate of about $250,000 for the current calendar year. For New Zealand the figures are January, $2128; February, $962; March, $781; April $5960, or at the rate of about $40,000 annually.

INDUSTRIAL HEATING SALES SHOW IMPROVEMENT

One Manufacturer of Equipment Finds Commercial Orders Increasing at Good Rate—Bright Future Predicted

A prominent manufacturer recently summed up the outlook for the part to be played by electricity in the industrial heating field with the sentiment that industrial heating stands now where motors stood twenty-five years ago. Reference was made in particular to the heat treatment of steel, the melting of non-ferrous metals and japanning and baking ovens.

War requirements in the industrial heating field dropped off for this manufacturer about September 1918, as by that time the demand had been pretty well supplied. The commercial demand started in immediately after the

armistice, and by the end of last year were almost up to the rate required earlier in the year for war purposes. Orders on industrial heating, comprising control equipment for the steel furnaces, electric equipment for non-ferrous melting furnaces and heating elements and control for japanning and baking ovens were running along at even level from the first of the year to the latter part of May. About that time the orders gradually mounted; so that at the end of the first half of the present year they were running about 10 per cent above what they were during the first quarter. The prediction is made by this manufacturer that his orders will be increased to 40 per cent above the first quarter's rate by the end of the year.

With manufacturing conditions running at a comfortable capacity, deliveries are rather long, being in the neighborhood of six months. Prices have been holding rather steady although the tendency is upward with copper rising and steel also tending in that direction.

There is hardly a manufacturer using steel but that he needs special heat treatment for that steel, and the market for heat treating furnaces is hardly scratched. The Eastern market is growing rapidly for this class of work, along with the market for non-ferrous melting work and ovens, while in the steel-mill section of the country steel melting furnaces are increasing in number. Automobile manufacturers have been and still are heavy users of ovens, so the Middle West is showing up with increasing activity for that line of heat treating.

MANY SALES REPORTED FOR LOCOMOTIVE HEADLIGHTS

Steam Railroads Fast Adopting Turbo-Generators—Other Applications Being Found —Increased Field

Out of the war has come a line of small steam turbo-electric units which is destined to find application beyond that which originally required its manufacture. The order of the Railroad Administration requiring all steam locomotives to be equipped with electric headlights by July 1, 1920, has resulted in the manufacture of turbo-electric units in sizes from 500 to about 2500 watts, at this time, by seven different manufacturers.

These smaller units are only for headlight and cab use, while the larger units may be used for locomotive and car use. The 500-watt generators are finding the more general sale as it is not necessary to go beyond headlight requirements. Several manufacturers say that with the varying types of cars, some already electrically equipped and some not, it would be duplicating generating equipment, and the extra capacity in the locomotive generator would be unnecessary.

The attitude of most of the railroads so far has been to equip electrically all locomotives that have gone to the shop for repairs or overhauling. Some roads have even gone to the extent of sending their locomotives in for this equipment, while others have deferred to the limit all such applications. The original hesistancy and antipathy of locomotive engineers to the adoption of this lighting has been gradually overcome.

Already new applications for the use of these small generating equipments have been found where steam is available and where electric lighting is desired. Dredges, locomotive cranes, hoists, tugboats and other classes of apparatus have purchased them, now only in small quantities, but the field has hardly been scratched. From all appearances there is a bright future for these small generators.

Most of the equipments are direct-current, but one manufacturer has turned out an alternating-current generator. The voltage is 32 volts.

Incidentally this equipment has provided a larger market for heater cord. At one time last winter very little heater cord was available, owing in no small measure to the railroad demand. Also a new line of switches has been developed for this market, a ruggedly constructed double throw switch, one side for dimming and the other for full light.

ROLE OF UNITED STATES IN BRAZILIAN ELECTRICAI TRADE

Eighty Per Cent. of Electrical Imports in 1916 and 83 Per Cent in 1917 of American Manufacture

The United States has always occupied a favorable position in the Brazilian electrical trade. The sales figures for the years 1916 and 1917, just received, show that in the former 80 per cent of the electrical imports in Brazil were from the United States while in 1917 83 per cent were from the United States. In these two years Great Britain was the nearest competitor for this trade, but, as shown in the table, was not a very serious factor. Switzerland sent considerable equipment to Brazil, including generators to the value of $26,000 in 1916 and $55,000 in 1917 and motors to the value of $40,000 in 1916 and $29,000 in 1917. France sent $37,000 of miscellaneous electrical macinery in 1916, $24,000 in 1917. Italian cables to the value of $25,000 were imported into Brazil in 1916 and to the value of $21,000 in 1917. Holland was the nearest competitor with the United States in the incandescent-lamp trade, having sent $40,000 worth of lamps in 1916 and $55,000 worth in 1917.

Items	United States	Great Britain	Total
Generators:			
1916	$43,500	$7,000	$83,000
1917	36,000	.....	107,000
Motors:			
1916	42,000	28,000	13,000
1917	100,000	18,000	168,000
Trasnformers:			
1916	131,000	14,000	152,000
1917	91,000	4,000	107,000
Cable:			
1916	381,000	34,000	449,000
1917	722,000	19,000	830,000
Copper wire:			
1916	342,000	9,000	365,000
1917	346,000	2,000	361,000
Bare copper wire:			
1916	27,000	2,000	30,000
1917	19,000	.....	19,000
Insulators:			
1916	53,000	17,000	75,000
1917	71,000	27,000	102,000
Incandescent lamps:			
1916	237,000	14,000	312,000
1917	370,000	17,000	455,000
Other electrical machinery:			
1916	876,000	128,000	1,126,000
1917	1,349,000	129,000	1,594,000
Totals:			
1916	$2,132,500	$253,000	$2,715,000
1917	3,104,000	216,000	3,743,000

PRICE CONDITIONS IN ELECTRICAL GOODS TIGHTENING

General Price Cutting Period Appears to be Past and But Few Concessions Are Now Being Granted

A very perceptible tightening up process is going on in the electrical market, all along the line, even in many cases to export orders. When the armistice was signed and it became apparent that the flood of government orders then choking the producing capacity of the country were going to be cancelled in a very large measure, the electrical manufacturers found themselves in many instances faced with the prospects of materially curtailing production and discharging labor, or else doing something to stimulate the placing of orders.

Then it was that the word went out to the sales people to get business. Quotations were made considerably under war prices. It virtually came down in many instances to the buyer naming a price and the salesman accepting it. Where more than one firm was bidding, and this was especially true of apparatus and station equipment, prices were slashed repeatedly. In one instance the salesman was told to forget factory cost but just get the business. The cost would be taken care of after the order was received.

Such conditions, however, seem to have gone by. The under tone of the market seems to be so fundamentally

strong that there is no occasion to go out and cut prices right and left. To be sure, concessions are still being made, but on a more sane basis. Quotations are now made on the basis of printed prices. If the buyer simply won't pay that price, the salesmen, in large apparatus at least ,are willing to make a reasonable concession.

It will not be long, however, before even this practice will go into the discard. Business is picking up rapidly, and indications are that before long production will be below bookings. The necessity, therefore, for taking business at a price under the printed schedule is becoming less and less.

METAL MARKET SITUATION

A 1⅛ Cent Rise Brings Copper to 19.87½ Cents—Sales Increasing

July copper is quoted at 19.87½ cents, August at 20 cents and one producer only has given a figure at which he will sell for September delivery and that was 20.25 cents. This hesitancy of producers to quote for deliveries beyond August shows the tendency of the copper market upward to an extent that only one producer is willing to place a price on it. A strong factor in this respect is the attitude of labor in the Montana mines. Regardless of how unreasonable these demands may seem to be, there is nevertheless food for though in the possible outcome with respect to future prices.

Only three weeks ago when copper sold at 17.75 cents, the prediction of 20 cent copper by early fall was made. Now with the spot price at ¼ cent under this figure, some leading copper authorities have hazarded a price of 23 cents by fall, and one prediction has been made of 25 cents.

Electrical manufacturers have been purchasing copper in fair quantities and the buying has been steady. No noticeable spurts have been made nor are they looked for at this time, but the market has been going merrily upward with surprising strength. June's purchases of copper have been estimated at 200,000,000 pounds, and sales of the first week in July have been estimated at 10,000,000 pounds a day.

The domestic tin market is quiet but the end of the last week the London spot market advanced over £7 per ton. The War Trade Board Section of the Department of State announces that it will issue licenses permitting importation, on and after September 1, of pig tin and all metal alloys containing tin, from points other than points of origin and without references to date of shipment.

Zinc has advanced about $2 per ton, and this in the face of a quiet domestic market. There is little purchasing, except for zinc for export.

The scrap market has shown slight fractional advances among the coppers and brass.

NEW YORK METAL MARKET PRICES

	July 1	July 9
Copper:	£ s d	£ s d
London, standard spot	87 0 0	95 5 0
	Cents per Pound	Cents per Pound
Prime Lake	19.25	20.25
Electrolytic	18.75	19.87½
Casting	18.25	19.25
Wire base	20.50 to 20.75	21.75 to 22.00
Lead, trust price	5.40	5.40
Antimony	8.37½	8.37½
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Spelter, spot	7.35	7.45
Tin	70.50	70.50
Aluminum, 98 to 99 per cent	33.00	32.00 to 33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	16.00 to 16.50	16.50 to 16.75
Brass, heavy	8.50 to 9.50	8.75 to 9.75
Brass, light	7.75 to 8.25	8.25 to 8.50
Lead, heavy	4.75 to 4.87	4.75 to 4.87
Zinc, old scrap	4.75 to 5.25	5.00 to 5.25

THE WEEK
IN TRADE

SALES volumes are increasing right along. Deliveries are lengthening in more and more lines and in not a few shortages are developing.

Prices show a marked tendency upward, with mounting costs of raw materials and labor. Price cutting by jobbers is taking place in several localities.

New construction is increasing and bids fair to become considerable before the winter months arrive. Serious housing shortages have developed in a number of important industrial centers.

Collections are doing very well. Reports of payments in shorter time are coming in from many cities. Credits seem firm.

NEW YORK

Business is reported on a little better basis and sales are keeping up in good shape. The amount of copper bought recently for conversion into wire is encouraging, in its pointing the way to line extensions and anticipated building. Transformer, meter, lightning arrester and feeder regulator sales show central station developments along the same lines. Wiring equipment for houses is selling in bigger volume.

Although the demand for steel for building purposes has not reached normal, there is encouragement in the estimate that building, projected during June, will consume about half as much again of steel as that required to complete construction projected during May. The number of houses or apartments needed to care for the increased population in New York is over 36,000, according to the New York State Reconstruction Commission. The sections of the state away from the larger cities show considerable amounts of small home building, while in the cities there are a few apartments under way.

Among jobbers, strict adherence to the 30-day credit ruling is keeping collections in extremely good condition.

MOTORS.—Sizes up to 10 and 15 hp. are selling better. Sales of motors for sewing machine group-drive are increasing, both high-speed motors with reduced drive to table shaft, and slow-speed, direct-current motors, direct coupled to table shaft.

TRANSFORMERS.—Heavy recent sales of pole-type transformers have reduced New York stocks of one manufacturer to a low figure. Replacements were ordered when stocks reached the minimum permitted, but to date have not come in from the factory.

MOULDED INSULATION.—Larger size orders are coming through from present users of moulded insulation.

METERS.—House meters have found a much better demand recently. This is in line with the activity in distribution transformers and pole-type lightning arresters.

CROSS-ARMS. — Price increases have just gone into effect, although at this writing the amount of increase is not available. It will probably be in the nature of a 10 to 15 per cent rise. Stocks are in quantity to make good deliveries.

FLEXIBLE ARMORED CONDUCTOR.—Demand is still high, and manufacturing conditions are still behind-hand on shipments. No relief is at present in sight.

WIRELESS.—Sales of wireless equipment have considerably increased of late. High-class amateurs are to a great extent in the field at present, and sales of apparatus running into several hundred dollars each are quite common. Quality, rather than price, seems to be the ruling factor.

SCHEDULE MATERIAL.—Price cutting by jobbers in this material is rampant in New York City. This is not because of any desire to move large stocks, but is on brand-

new business. Much cutting is down to within a low percentage of jobbers' cost.

LAMPS.—The new Mazda C-4 is not yet in all distributers' hands, but some have received small stocks. Manufacturers are building up stocks. It is expected that all distributers will soon be supplied. The mill-type lamp is finding increasing sales in electric railway work.

FANS.—Stocks of large size oscillating fans are still short in some jobbers' hands. Shoppers find they have to take the best they can find of other sizes. Sizes under 10-inch are not finding their expected market, and already some dealers are cutting prices. Some jobbers have no intention of filling up on any sizes, while others are still awaiting further factory shipments.

WIRE.— Bare base is still on 23 cents, although a higher base is expected any time, as copper is still rising. Better wire buying of all kinds is reported from the mills.

CHICAGO

Jobbers did a good business in June. It was even better than last June, which was exceptionally good with a great many of them. The principal increases were in line materials and household devices. In spite of there being two holidays last week, the Chicago building permits exceeded $2,200,000, which might be considered fair. It was announced during the week that six new industrial buildings would be erected at a cost of $2,525,000. It is estimated that, after allowing for new buildings which have been erected, Chicago still needs new accommodations for 50,000 families. In order to encourage building in Duluth, Minn., the Duluth Builders' Exchange furnishes free plans to any person who will build a home. The Marshall-Wells Company of Duluth is building $4000 and $4500 homes to be sold to employees at cost.

Agreements have been reached between the Illinois Central Railroad, the South Park Commission, and the committee of the City Council on the Illinois Central electrification, which has been under negotiation for about eight years. The bill has been reported out of committee, and some definite action by the Chicago City Council is expected shortly. On other extensions and improvements the Illinois Central plans to spend $2,512,000 in and around Chicago in the immediate future.

COPPER WIRE.—The upward trend of the market is inducing purchases for contracts which have been closed but not executed. Most of the jobbers reported greater demand for rubber-covered wire than for weatherproof last week. The price of rubber-covered wire remains on a 24-cent base, although some jobbers are still selling on 23 cents. The price of weatherproof was advanced from 24 cents to a 25-cent base, with some sales being closed at the lower figure.

CONDUIT.—Large quantities of conduit will be required for work now on contractors' books, but as no immediate price increase is expected, the material is not being purchased until required. Unless conduit buying starts soon and is spread over an extended period of time, it is doubtful whether stocks will be adequate to meet the demand.

FANS.—Practically all the jobbers sold more oscillating fans than they thought possible at present prices. The fans are not staying on the dealers' shelves, either. In most cases dealers also find it difficult to keep up their stock.

SCHEDULE MATERIAL.—Comparatively little is being sold. Buyers seem to expect a reduction in price. Jobbers don't look for any price reduction, however, and when necessity compels the placing of orders, the jobbers' stocks may not be sufficient to supply the demand.

CROSS ARMS.—There was an advance of about 10 per cent in price last week. The buying has not been as heavy as might have been expected from the extensive line construction going on and the warning of coming higher prices.

MOTORS.—There is an increasing call for motors and the sales are not limited to the smaller sizes as was the case a few weeks ago. Present sales are running into motors up to about 150 hp. There are sufficient orders to go around, and concessions are not necessary.

LIGHTING SPECIALTIES.—There is a good demand not only from wholesale and retail establishments but for industrial plants. Extensive sales are reported to textile mills in the south and to metal working industries in and around Chicago.

ELECTRIC SIGNS.—The usual summer slump is not expected this year. Two of the manufacturers in the Middle West have sufficient business on their books and in sight to carry them through the hot weather.

BOSTON

The protracted holiday cut down the volume of trade considerably last week, and it appears too early to note any general increase in orders following the signing of the Peace Treaty. Jobbers are well satisfied, however, with the way trade has been improving in the past few weeks. A gradual increase in both inquiries and orders is noted. Stocks are running low in some lines, notably in small single-phase motors, brass fixtures, armored flexible conductor and some makes of electric washers. Fans are moving fast. Collections continue good. Prices rule firm, with upward tendencies in wire from week to week. Labor conditions are unsettled and costs threaten to force some further price increases. The need of more production as an offset to rising prices is coming to be more widely recognized. Deliveries are generally good; in some lines they are better than for years, but in others there is a tendency toward longer periods between order and shipment.

WIRE.—Rubber-covered wire rose to 25 cents base last week, weatherproof was quoted at 22½ cents and base at 22¾ cents. Deliveries are getting a bit slower in some cases, though some dealers report substantial stocks. A fair demand is noted.

FRICTION TAPE.—Stocks are moving well, and are being satisfactorily maintained. Prices are very steady.

FIXTURES.—Stocks are decidedly lower than a few weeks ago. Labor troubles in the "brass counties" of Connecticut have curtailed production, and long stocks of the war period are being sold down rapidly. Cheap glassware is short. The mercantile demand is good and the residential trade holds up well. Prices on some brass goods are up about 10 per cent.

SWITCHES AND SOCKETS.—Jobbers are buying more schedule materials than a month or so ago. Prices are still fairly steady. Factory stocks are beginning to shrink from the increasing demand. Porcelain is plentiful, but the brass situation is disturbed by labor difficulties, and the delivery question is somewhat uncertain.

MOTORS.—Business is brisk in smaller sizes. Many demands for small single-phase motors cannot be filled in less than six to eight weeks, especially from ¼ to 3 horsepower, 110 and 220-volt, 1800 r.p.m. Local stocks of small three-phase and direct-current motors are better in range, but much remains to be done in building up sizes and types. Prices are fairly steady, with minor readjustments and some slight weakness under close competition. The demand seems to be gradually increasing. By and large, deliveries are probably twice as prompt as a few months ago.

POLICE TELEGRAPH APPARATUS.—A brisk demand is noted as improved police protection plans are being put into effect. Prices are steady.

FIRE ALARM APPARATUS.—The municipal demand is better than a month or so ago. Industrial business is quiet. Labor costs are up, but as yet prices are steady.

FANS.—A rush business was handled last week, but owing to the holiday week-end and to the recent extensive buying, stocks met the demand well. Prices are well maintained. There will probably be further re-stocking of fans for a week or two at least.

INDUSTRIAL ELECTRIC TRUCKS.—The improvement in interest continues and orders reflect a better feeling. Prices of trucks tend to reflect the recent advance in some battery types.

STREET-LIGHTING HARDWARE.—A fair demand is noted. Prices tend to harden slightly.

ATLANTA

Manufacturers, jobbers and dealer contractors report business as being very active. Prices on the whole remain steady and increasing length of shipment is not deterring the buying element. Construction of all kind continues to grow and advancing progress of work under way calls for greater quantities of electrical material. Labor is being absorbed and shortages exist in certain lines.

CONDUIT.—Black and white rigid is moving briskly. Jobbers are filling good orders from all sections. No change is noted in prices. Local stocks are in fair shape, but factory promises of shipments are growing longer, running now from 10 days to four weeks.

STEEL BOXES.—A rapid movement of boxes is evident from reports of jobbers. Local stocks are well filled and factory shipments are prompt.

HOISTS.—Inquiries are numerous and the number of outstanding quotations are swelling daily; and while immediate orders are coming in slowly, a substantial future business is expected by the manufacturers when plants decide to get away from a labor basis. Shipment promises are getting better.

STEEL ARMORED CABLE.—The demand this week shows a considerable increase, even in the face of a 5 per cent advance in price. Southeastern stocks are practically depleted. Factories promise three weeks delivery, but they never materialize.

FLEXIBLE STEEL CABLE.—The market is lifeless and stocks are moving slowly. The falling off in demand in individual motor wiring at textile centers is being reflected in the call for this product. Factory shipments are normal.

MOTORS.—Manufacturers report an increased demand for all capacities up to 200 horsepower this week. This is accounted for by the seasonal buying of cotton seed oil mills and gins that are getting ready for this fall. Factory shipments show marked improvement and as a consequence southeastern stocks are reaching normal conditions.

PANEL-BOARDS.—Prices are steady. The volume of transactions shows a considerable gain over the previous week and as apartment construction and small building advances, the market for this product is expected to become still more active and of wider scope. Shipments on standard panel-boards have increased to three weeks. Cabinet deliveries have slowed up approximately two weeks.

EXHAUST FANS.—Dealers have enjoyed a good business this year so far in 18-inch to 36-inch sizes. This week's sales show a slight decline over records made for May and June. But even then the market is active and trade is quite satisfactory. Manufacturers have done a larger "drop shipment" business this year than ever before. Prices are off 15 per cent compared against last season. The unexpected call has reduced stocks to 50 per cent of normal.

APPARATUS.—The volume of sales this week indicates that another streak of buying is on the way. Inquiries are heavy and bona fide completed transactions are well above those negotiated in June. Generators up to 500 kw. for the smaller municipal lighting plants are receiving their share of attention and manufacturers are looking forward to a good business from now on. Comparatively prompt deliveries are being made from factories.

FANS.—The cool weather experienced by the Southeast this week has tended to again slow up the movement of fans; but, on the whole, the turnover so far is fairly satisfactory. A few jobbers report shortages in 16-inch oscillating and ceiling fans, otherwise stocks are in good condition.

SEATTLE—PORTLAND

Appliance sales are moving faster than ever before in the history of the Northwest. Nearly every appliance is having a heavy sale, although washing machines, vacuum cleaners and irons are the fastest movers. During the past week several orders of considerable size for dishwashing machines and ranges were placed. An indication of the demand for electric appliances is shown by the recent opening of four retail stores in Seattle. Range sales are not being pushed in Seattle on account of the lack of energy. Jobbers, as a whole, in Seattle report that sales to shipyards and industrials are far below the war period and still decreasing. The Blodel Donovan Lumber Company, Bellingham, will spend $150,000 in extensions. Considerable additional electrical equipment will be installed.

On Aug. 12, Tacoma voters will ballot on issuing $300,000 bonds to purchase Lake Cushman power site. The superintendent of municipal lighting at Seattle states that serious shortage of energy will soon be at hand unless prompt action is taken to rush construction of an additional 10,000 kw. unit at Lake Union steam plant.

Lumber mill operators of western Washington and Oregon are rejecting orders, and heavily restricted production during July and August is certain because of necessity of closing down for repairs and extensions. Electrification of plants, some in their entirety, is practically assured. Talk of a large steel plant, in or near Seattle, sufficient to meet requirements of Pacific Coast and Orient, is renewed. The coast-wide strike of telephone and electrical workers struck Seattle July 2, slowing up business considerably. In Seattle fair service with non-union operators is being maintained. No attempt is being made to replace linemen or wiremen.

Portland territory reports very little change in general business conditions. Copper shows a decided upward trend in price. Other prices remain about the same as they have for the past few weeks. Sales in household appliances have been particularly active all spring and summer and have shown no tendency toward a decrease. There is an unusual demand for electric ranges and washing machines. Collections are good. One large retail electrical store which sells a large number of appliances on the monthly payment basis states that though they have a good many thousand dollars' worth of contracts out, payments were made so regularly that they do not keep a collector. Building in Portland, particularly residences and small business structures, is being maintained. June, 1919, far exceeded the same month of last year, in spite of war time building.

SAN FRANCISCO

Building permits for June figured as follows: Los Angeles, $1,900,000; San Francisco, $1,600,000; Oakland, $700,000. There have cropped up many large jobs, which is a change from the reports for the past few months, which have consisted principally of small residences and buildings. Vallejo should have a great deal of building because the contemplated removal of one-half of the United States mobile fleet to the Pacific. This will render necessary a lot of dry docking and repair work at the Mare Island yard near Vallejo. In fact, the shipbuilding operations in the vicinity have caused an inconvenient congestion of quarters.

Following the practice of 1918, in assigning a certain definite vacation period to the outside salesmen of all electrical jobbers, the last week of July and the first week of August, 1919, have been assigned for a similar purpose, and this practic, it is said, will be extended to many of the dealers' and contractors' forces.

Collections are fair, and credit extensions are conservative, although the long term payments on household devices, tend to increase the outstanding amounts.

HEATING MATERIAL.—Many dealers report sales of expensive electrical table ware, in a greatly increased volume over previous years.

FANS.—This has been an excellent fan year, both from weather conditions, which have been ideal for such business, and the prevalence of money. Fan conditions have been somewhat upset, due to conflicting prices and the presence of large numbers of bargain types of fans.

WIRELESS MATERIAL.—The removal of the government ban on private radio plants has recreated this business, which was so flourishing before the war. Several inquiries for wireless telephone apparatus have been reported, although such apparatus is still classified as governmental.

SEWING MACHINES.—The sale of at least four carloads of electric sewing machines, in small lots to various electrical dealers, has been reported during the past six months. The new prices, which give dealers a better profit, enable them to accept the exchange of old machines.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

Armored Conductor, Flexible Steel

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

Twin-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	5%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$100.00
Coil to 1000 ft	82.50
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

Attachment Plugs

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to list
1/5 to std. pkg	List to 20%
Std. pkg	23% to 36%

Batteries, Dry

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	40	40— 41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

Batteries, Dry—*Continued*

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

Conduit, Metallic Flexible

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
⅝	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
½-in. single trip	$75.00	$63.75— 69.75
½-in. double strip	75.00— 82.50	72.00— 75.00
¾-in. single strip	100.00	85.00— 93.00
¾-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
½-in. single strip	$75.00	$63.25 to $63.75
½-in. double strip	78.25	71.25
¾-in. single strip	100.00	75.00 to 85.00
¾-in. double strip	105.00	93.00 to 95.00

Conduit, Non-Metallic Flexible

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
⅝	.09	1½	.40
¾	.12	1¾	.47
⅞	.15	2	.55
1	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
½-in.—	$25.00	$20.75	$21.50
¾-in.—	30.00	21.50	20.50

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
½-in.—	$42.00	$21.00	$19.50
¾-in.—	45.00	22.75	21.25

Conduit, Couplings and Elbows, Rigid Iron

Card No. 40

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
¾	.17
1	.23
1¼	.27½
1½	.37½
2	.58½
2½	.76½
3	

Conduit, Couplings and Elbows, Rigid Iron—*Continued*

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
¾	.13	.37
1	.17	.45
1¼	.21	.50
1½	.28	1.10
2	.40	1.80
2½	.60	4.80
3		

DISCOUNT—NEW YORK

	⅛ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 12.1%	6% to 14.1%
2500 to 5000 lb.	9% to 15.1%	11% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	⅛ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3% to 6.1%	2% to 8.1%
2500 to 5000 lb.	+1% to 11.1%	4% to 13.1%

(For galvanized deduct six points from above discounts.)

Flatirons

NEW YORK

List price	$6.50 to $7.50
Discount	25%

CHICAGO

List price	$6.50 to $7.50
Discount	25% to 30%

Fuses, Inclosed

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40%

Fuse Plugs

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List each, $0.07

Lamps, Mazda or Tungsten

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

Lamp Cord

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$26.47–$35.01
Coil to 1000 ft	23.82– 29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$31.00
Coil to 1000 ft	22.00

Lamp Guards, Wire

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

Outlet Boxes

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–30%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	33%–40%	24%–32%
$10.00 to $50.00 list	45%–50%	32%–43%

Pipe Fittings

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

Porcelain Cleats—Unglazed

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15.00 to $22.40
1/5 to std. pkg	12.00 to 15.35

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$17.85–$24.15
1/5 to std. pkg	14.70– 21.00
Standard pkg., 2200. List per 1000.	$20.00 to 21.00

Porcelain Knobs

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg	10.50– 11.20	15.35– 18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$13.60–$18.40	$27.20–$36.80
1/5 to std. pkg	11.20– 16.00	22.40– 32.00

Sockets and Receptacles

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT .W YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20 to list
1/5 std. pkg	List to 10%

Switches, Knife

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

Switches, Snap and Flush

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

Switches, Snap and Flush—*Continued*

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	23%

Switch Boxes, Sectional Conduit

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	30% to 33%	24% to 25%
$2.00 to $10.00 list	30% to 33%	24% to 25%
$10.00 to $50.00 list	30% to 45%	25% to 36%

Toasters, Upright

NEW YORK

List price	$6.00 to $7.00
Discount	25%

CHICAGO

List price	$7.00
Discount	25% to 30%

Wire, Annunciator

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.43
No. 18, full spools	.35– .41

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.46 to $0.56
No. 18, full spools	.41 to .51

Wire, Rubber-Covered, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.15–$15.00	$12.65–$14.00	$9.25–$10.60
12	19.26	19.26	14.45
10	26.04	26.04	17.36
8	35.82	29.85	23.88
6	56.70	47.25	37.80

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.50	$10.00–$11.00	$9.50–$10.00
12	22.05	22.05	18.90
10	29.68	29.08	25.44
8	40.59	34.62	24.62
6	63.84	54.72	54.72

Wire, Weatherproof

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$28.00–$29.25
25 to 50 lb	28.00– 25.25
50 to 100 lb	27.00– 23.25

CHICAGO

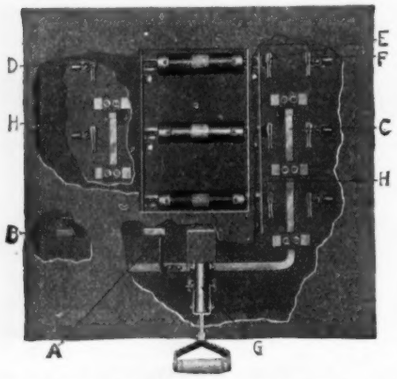
	Per 100 Lb. Net
Less than 25 lb	$26.50 to $27.75
25 to 50 lb	26.50 to 27.75
50 to 100 lb	26.50 to 27.75

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Safety Switch for Heavy Duty Use

A "super-duty" switch for use on standard ratings of 100 amp. and over at 600 volts, and 200 amp. and over at 250 volts is being placed on the market by the Palmer Electric & Manufacturing Company of Boston, Mass. It em-



CONTACT BROKEN IN FOUR POINTS ON EACH CURRENT LEG

bodies the general features found in the standard line of heavy duty switches manufactured by this company in that the fuses are necessarily disconnected from all possible sources of potential before they can be handled, giving to this switch, according to the makers, the class AA fire and accident rating of the Underwriters Laboratories. The switch and cut-out structure is mounted on a slate base so arranged that the circuit through each leg is broken at four points by a quick break in opening. This is a distinct departure from conventional switch construction in which the break occurs at one point only, and it is claimed by the manufacturers that where switches are subjected to heavy duty it is fully as great an advantage to use a multi-break switch as it is to make use of a multi-gap construction in lightning arresters.

Referring to the illustration, the switch blades are moved into closed position with the contacts E, F, etc., by means of a handle G. This construction gives a double break on either side of each fuse at E, F, D, etc. A slide shutter H travels along guides on the main box cover, and when in a position in which the fuses are exposed carries the angle-piece B into such relation with A that the switch cannot be closed so long as the slide H is even partially open. When the slide H is fully closed, the switch may be closed, the part A moving just beyond the end of the angle B so as to lock the slide H against opening motion as long as the switch is held in even partially closed position. The contacts E, F. D, etc., may be removed from the base of the slate without taking the latter from the box. The contacts are secured by standard Ackerman-Johnson anchors which do not require the slate being drilled through, so that the use of wax on the back of the panels is avoided, an important matter in operating switches at 500 volts and over.

Vibrating Rectifier for Battery Charging

As advantageous features of the Cambridge vibrating rectifier which it has developed for charging storage batteries from alternating current energy in homes, garages or laboratories where a large number of cells need not be charged at one time the Clapp-Eastham Company of Cambridge, Mass., points out that in the device there are no lamps, rheostats, liquids or other parts likely to become broken or requiring frequent renewal, the cost of maintenance is negligible and the instrument is ready for service whenever needed. No special wiring is required. Any lamp socket supplying 60-cycle alternating current may be used, and a battery may not only be charged over night if desired but it need not be removed from the automobile or other place of mounting.

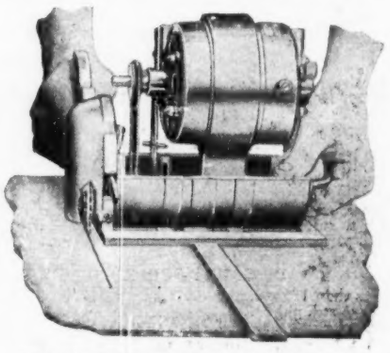
Simplicity of use is also a characteristic of the rectifier, the maker says. The plug is screwed into the lamp socket, the two wires connected from the rectifier to the storage battery terminals and charging commences. To connect the rectifier in the wrong direction is declared to be impossible. The rectifier is self-starting and in the event of a temporary failure of the supply current, the battery is automatically cut off so that it cannot discharge back through the rectifier. Upon restoration of service it automatically resumes the charging operation.

In actuating the charger the current upon entering the rectifier is passed through a transformer to lower its voltage to slightly more than that of the battery. It is then conducted through a vibrating reed which oscillates in unison with changes in direction of the alternating current. On the end of this reed is a contact point that contacts with another similar point connected to the storage battery whenever the current is flowing in the correct direction to charge the battery and disconnects the battery from the circuit, when the current is flowing in the wrong direction. Thus impulses flow into the battery in one direction only, and the instrument is so constructed that it automatically charges in the right direction regardless of which way the battery is connected.

Portable Electric Saw

For use where stationary saws are impracticable or inconvenient the Router Manufacturing Company of Oshkosh, Wis., has developed the Casey portable electric saw which can be taken directly to the work and connected to an ordinary lighting socket. Among its uses are removing sticking from doors, removing panels, crating, cabinet making and carpenter work, cut openings, groove joints, house joints, splicing and pattern making. The saw is self-contained, weighs but 12 lb. (5 kg.) and is suited to unlimited work up to 1 in. (2.5 cm.) stock, the maker declares. The saw is guided across the boards by tracks which clamp over them and can be quickly adjusted to any angle.

The machine is mounted on the cylindrical base with a ¼-hp. universal electrical motor with a high speed of 12,000 r.p.m. A 3¼-in. (8-cm.) Disston's saw-cross and rip is used and high-speed tool steel saws can be furnished. Filing is done away with. All bearings are detachably mounted and equipped with lubricating cups. Endless belts with belt adjusting rod make



TRACKS CLAMPED ON BOARD AT ANY ANGLE INSURE ACCURACY

the saw fool-proof against trouble. The saw is guarded and the machine has a slide gage for ripping which moves along the base. The handle of the saw can be firmly gripped, operation being controlled by a button.

Grinder wheels, buffing wheels and

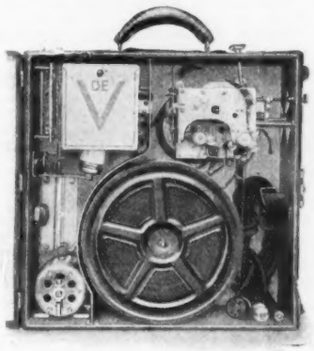
drill chucks for woodwork can also be used with this machine, thus increasing its usefulness.

Portable Motion Picture Machine

Two improved models of its portable motion picture projector are being manufactured by the De Vry Corporation of 1248 Marianna Street, Chicago. One—the Exhibition model—is designed for use on 110-125 volt, alternating- or direct-current, and can be used in classrooms, auditoriums, hospitals, churches, industrial plants, etc. The other type—the Universal model—is primarily intended for operation on independent lighting plants generating 30-35 volt direct current. It may be used with success, the maker says, by traveling exhibitors, tent shows, small town theaters and other similar places.

Both models take standard size films and reels and project a 12 ft. (36.5 cm.) picture to any distance from 50 to 80 ft. (15 to 24 m.) according to the focal length lens. Portability has been given prominent consideration in designing the projectors. All the parts are permanently attached within the case yet all focusing, framing, starting, motor-control and illumination are controlled from the outside of the case. As the total current consumption of the lamp and the motor used to run and rewind the film does not exceed 500 watts the projector can be connected to the ordinary light socket. By a small dimmer placed directly back of the lamp house and connected in series with the lamp, the illumination may be varied to suit the size of the picture, density of the film, or darkness of the room.

All the working parts of the machine are built of steel or bronze making for small size and lightness of weight. The drive shaft is ball-bearing mounted. The intermittent sprocket engages more perforations in the film than is customary, giving maximum service from a single reel of film. The feed and take-



FILM REWOUND BY ELECTRIC MOTOR

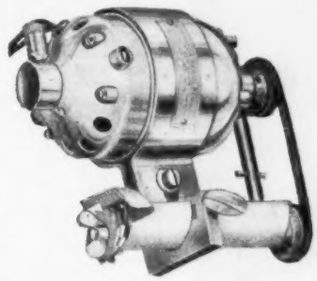
up sprocket engage the film with double idlers which are locked in place so that a film in poor physical condition can be satisfactorily run through the projector.

The projectors weigh 20½ lbs. (9.2 kg.) and have dimensions of 17 by 17 by 7 in. (43 by 43 by 17.7 cm.).

Motor-Driven Portable Putty Router

The Casey electrically operated putty-router manufactured by the Router Manufacturing Company, Oshosh, Wis., removes putty from all styles of glass windows, re-babbets the sash and makes a clean cut, removing points at the same time in one operation. It is compact, portable, quickly adjustable and can be attached to any lamp socket.

The router is operated by a $\frac{1}{12}$-hp. universal motor, with a speed of 12,000 r.p.m. and is instantly controlled by a push button switch. The base is of aluminum and has detachable bearings. High speed tool steel cutters are used and are connected to the motors by a belt with an adjusting rod. A slide gage moves along the base and fits any window sash. A guard is furnished to afford protection to the operator from accidental contact with the cutters. A grinder wheel which can be



SAVES TIME IN REPLACING WINDOW GLASS

placed on the arbor by removing the cutters is furnished to grind the latter. A 10-ft. (3-m.) cord, a switch and a socket plug are supplied with the router.

Battery-Charger for Private Garages

To meet the requirements of the automobile owner who desires to charge his starting and lighting battery at home or in a private garage, a "private garage" type "Tungar" battery charger is being manufactured by the General Electric Company of Schenectady, N. Y. It operates on standard 115 volt, 60 cycle, alternating current lighting circuits and will charge one 3-cell battery at 5 amp., two 3-cell batteries at 3 amp., three 3-cell batteries at 1½ amp., or one 6-cell battery at 3 amp.

Special effort has been made, the maker says, to make this device simple, compact and efficient. To operate the battery-charger it is set on the floor, on the running board of the auto or it may be hung on the wall. The direct current leads are then connected to the battery with the spring clips provided and the attaching plugs screwed into a convenient lamp socket. Charging commences immediately. The charger has been approved by the National Board of Fire Underwriters, it is stated, and can be safely operated over night without attention. Its essential parts consist of a "Tungar" bulb, for rectifying the current, and a transformer for reducing the voltage.

Electric Bell with Triple Tone

Three separate and distinct sounds are given by the "Tripletone" electric bell which operates on ordinary light-

THREE DISTINCT SOUNDS ARE GIVEN BY ONE BELL

ing current by means of a transformer and is being marketed by the Buhl Specialty Company of 9807 Easton Avenue, Cleveland, Ohio. In the home the bell can be connected with push buttons installed at three different doors, front, kitchen and side, for example. When one button is pressed a clear ring results, when the second is operated a buzz is produced, and when the third button is pushed a combined buzz and ring results. In the office or shop this bell will also prove useful since it can be used to call three different persons without necessitating them to count the number of rings, as must often be done when the customary signaling system is employed.

As the bell operates with the aid of a single- or triple-voltage transformer on an alternating current lighting circuit, the inconvenience of replacing easily exhausted dry batteries is eliminated. A common source of bell trouble is the burning out of contact points. This bell has no contact points to burn out.

Electrically Driven Iceless Refrigerator

Several improvements are now incorporated in the iceless electric refrigerator which is being marketed by the Isko Company, Conway Building, Chicago, and Astor Court Building, New York City. The present machine is of the directly-connected type with a water cooled condenser which is placed on top of the refrigerator. In the cooling compartment there is a brine tank which provides the cold-storage effect and an increased amount of ice freezing capacity. The compressor now used in the refrigerator is of the herringbone gear type instead of being reciprocating. Valves, pistons, and other parts subject to wear and needing attention are thereby eliminated.

Manufacturers' Activities

NATIONAL CARBON AMERICANIZATION WORK.—At the Cleveland, O., works of the National Carbon Company, small button badges, tricolored and imprinted with a patriotic shield, were awarded to charter members of a club organized among naturalized citizens recently by the Americanization committee. Classes in citizenship are conducted under the auspices of the committee which is determined to continue the war-time enthusiasm for things that are American permanently into the peace-time days.

HOLTZER-CABOT SALES CONVENTION AND OUTING.—The sales convention of the Holtzer-Cabot Electric Company, Roxbury, Mass., was held recently at the home office and factory in Boston. E. R. Harding, vice-president, and four of his Chicago executives were present, besides the branch managers and other salesmen

SIGNAL SYSTEMS DIVISION—THE HOLTZER-CABOT ELECTRIC COMPANY, BOSTON

from various cities. Several important items were discussed each day, including many new and improved devices which were demonstrated by the engineering staff. These meetings have been productive of so much good that it is planned to have them four or five times a year. As the various territories present different aspects of merchandising, the free interchange of opinions is of great assistance to all the selling staff. The proceedings were closed by a week-end stay at South Yarmouth on Cape Cod, about eighty miles from Boston. Personally owned automobiles carried a party of twenty-one both ways along the ideal Massachusetts roads.

CROWN ELECTRIC LOCKOUT ENDED.—Employees of the Crown Electric Company of St. Charles, Ill., who were locked out upon presentation of demands for an increase in wages, an 8-hour day, and recognition of the union, have returned to work, as a result of the efforts of Commissioner of Conciliation Oscar F. Nelson, of the Labor Adjustment Service, U. S. Department of Labor. They have received a 10 per cent increase in pay, elimination of overtime, and recognition of a shop committee.

DELCO-LIGHT SALESMEN'S CONVENTION.—A convention and school of Delco-Light salesmen of the St. Louis district was held recently in St. Louis under the auspices of the Del-Home Light Company, the St. Louis distributer. E. G. Biechler, sales manager of the Domestic Engineering Company, which manufactures the Delco-Light system for lighting farmhouses and other places not accessible to electric current, discussed distribution problems with the delegates. W. O. Waldsmith, president and treasurer of the Del-Home Company, presided.

SINGLE ORDER FOR 200,000 MAGNETOS.—The American Bosch Magneto Corporation, Springfield, Mass., has received an order for 200,000 magnetos. The contract involves about $2,500,000 and is equivalent to 40 per cent. of a normal year's turnover. About 1100 persons are now employed at the Springfield plant, and the payroll will shortly be enlarged to include about 1400. Deliveries are to begin in about thirty days. Aside from new automatic machinery, the plant will not be enlarged for the present. The order is said to be the largest ever received in the magneto production field either in this or any other country.

BLAW-KNOX COMPANY ENLARGES PLANT.—In connection with the sale of its plant located at Wheatland, Pa., to Sharon interests, the Blaw-Knox Company say that this is in line with the program which they outlined some time since for either the removal or sale of the Wheatland plant and the building of an extension to its plant at Hoboken, Pa., to take care of product formerly manufactured at Wheatland. This is done for the purpose of concentrating all of the manufacturing at Hoboken, which they have found to be the most advantageous point both for manufacturing and for shipping facilities. About one-half of their new plant at Hoboken has been completed, and it is anticipated that the entire addition will be completed within the next few weeks. The combined plants at Hoboken now under construction will contain about 30 per cent more floor space than was available in the two separate plants. The capacity of the enlarged plant at Hoboken for the manufacture of its product will be proportionately increased. In addition to the foregoing activities the Blaw-Knox Company is engaged in the construction of a welding plant at Hoboken adjoining its present plant, and will specialize in this department on steel mill and chemical plant specialties. The combined plants at Hoboken will employ about 1200 men as against 700 men who have been employed by the company heretofore at Hoboken and Wheatland. The manufacturing site of the company at Hoboken covers 50 acres, and in point of shipping facilities for incoming material and outgoing product as well as in the matter of labor supply is most fortunately situated. In order to take care of the additional labor required the company has purchased 15 acres of additional ground on which houses are being erected for the use of its workmen.

SURPLUS PLATINUM FOR SALE—The War Department is offering its present surplus of platinum for sale at a minimum of $105 per ounce, and iridium at a minimum of $200 per ounce, prices and orders subject to cancellation without notice. The sales will be made from the New York Assay Office and will be handled by the Committee on Sale of Materials, New York, District Ordnance Office, 1107 Broadway, New York. The minimum offer which will be considered by the committee will be for a quantity of 10 ounces, and the maximum amount that will be disposed of to a single purchaser will be 1000 ounces, unless the director of sales deems it advisable to grant special permission for a sale of larger quantities.

THE CARBO STEEL PRODUCTS COMPANY reports that it has moved its factory and office to 2600 West 111th Street, Morgan Park, Chicago.

W. D. BLOOD & COMPANY, Inc., has recently been organized as an export sales company with offices at 44 Whitehall Street, New York City, to represent principally American concerns in the automotive and hardware fields. Among the companies represented at the present time are the Witherbee Igniter Company of Springfield, Mass., and Witherbee Storage Battery Company, Inc., New York City.

THE LUNGMOTOR COMPANY of Boston announces that it has taken over the distribution of products manufactured by the Life Saving Devices Company, Chicago.

THE EXIDE BATTERY DEPOTS, INC., Philadelphia, has leased a factory in Thirty-sixth Street between Fields and Stewart Streets, Chicago.

THE TRENLE PORCELAIN COMPANY of East Liverpool, Ohio, announces that it has built a large new office, double the size of the old.

B. A. WESCHE ELECTRIC COMPANY, Cincinnati, O., announces the change of its Eastern sales agency address to 110 West 40th Street, New York City.

THE STANDARD ELECTRIC MANUFACTURING COMPANY, 24 Scott Street, Newark, N. J., has leased a portion of the building at 126 South Street for manufacturing purposes.

FRENCH-AMERICAN BANKING CORPORATION, Cedar and William Streets, New York City, has opened business in foreign banking and foreign trade of every description.

AKERLUND & SEMMES, INC., New York City, announces that Major George W. Semmes, vice-president and chief engineer, has just returned from France after nearly two years of service.

WONHAM, BATES & GOODE, INC., have opened a branch in Montreal at 355 Dominion Express Building in charge of A. G. Nutter, who was formerly with Mussens, Ltd.

THE HOOVER SUCTION SWEEPER COMPANY of North Canton, Ohio, the Federal Trade Commission reports, has agreed to cease giving bonuses or prizes to salesmen or dealers.

WALTER A. ZELNICKER SUPPLY Company of St. Louis has added 2000 sq.ft. to its present office space at 325 Locust St., St. Louis, Mo., an increase of 33⅓ per cent.

F. G. ECHOLS, for many years general manager of the small tools department of Pratt & Whitney Company, Hartford, Conn., has been elected vice president of the Greenfield Tap and Die Corporation, Greenfield, Mass.

THE WILLARD STORAGE BATTERY COMPANY, Cleveland, Ohio, has appointed S. W. Ralph retail sales manager, C. P. Lord assistant retail sales manager, and E. W. Fend, manager of the company's service station department.

THE INDIANA MILL & LUMBER COMPANY, 1405 Fisher Building, Chicago, has announced that it is handling a line of Southern white cedar poles in addition to its line of hardwood and pine railroad ties, piling, pine and oak timbers.

THE EDWARD VALVE & MANUFACTURING COMPANY, Chicago, announces that it has opened a Pacific Coast office at 223 Rialto Building, San Francisco, with F. J. Hearty as Pacific Coast representative.

THE ARROW ELECTRIC COMPANY, Hartford, Conn., reports that it has recently completed an addition to its factory, comprising three floors and a basement and adding 40,000 sq.ft. to its present plant.

THE CLEVELAND SWITCHBOARD COMPANY is now housed in its new factory building at 2925 East Seventy-ninth Street, Cleveland. The building is much larger than the former one. The present officers of the company are F. C. Hafemeister, president; F. F. Hafemeister, secretary; E. C. Leaming, treasurer; A. N. Rogers, sales manager and E. F. Blair, assistant manager. The company has opened a branch sales office at 1938 Dime Savings Bank Building, Detroit, Mich., with J. D. Nelson in charge.

THE DUNBAR BROTHERS COMPANY of Bristol, Conn., manufacturer of springs, reports it is tearing down all the old buildings connected with its plant and replacing them with a large brick extension, which will be equipped with the latest appliances for the prevention of fire. The floor space will be materially increased when these additions are completed and the necessary machinery installed, which it is contemplated will be in about four months' time.

WESTINGHOUSE CHURCH, KERR & COMPANY, INC., 37 Wall Street, New York City, announce the election of Arthur King Wood, formerly president of the Franklin Trust Company, as its vice-president and treasurer.

THE VICTORY STORAGE BATTERY COMPANY will be removed from Moline, Ill., to Rock Island, and a $52,000 factory will be erected. The factory will be 80 x 300 feet, of concrete and brick construction. More than forty men will be employed.

THE INDEPENDENT LAMP & WIRE COMPANY, 1733 Broadway, New York City, with works at Weehawken, N. J., has acquired property on Runyon Street, Newark, N. J., 260 ft. by 580 ft., for a new four-story plant designed to give employment to about 500 persons.

THE ELECTRIC FURNACE COMPANY, Alliance, Ohio, has just shipped one of its Standard 2000-lb. nose-tilting-type brass furnaces to the United States Navy Yard at Washington, D. C. The electrical requirements of this furnace will call for a demand of 105 kw.

THE WAPPLER ELECTRIC COMPANY, New York City, manufacturer of X-ray devices, etc., is arranging to increase its capital stock from $750,000 to $850,000 for expansion. It recently acquired property on Harris Avenue, Long Island City, for a three-story reinforced-concrete plant.

THE ELECTRIC FURNACE CONSTRUCTION COMPANY, Philadelphia, Pa., reports an order for an electric furnace to manufacture ferro-alloys in Spain, by the Sociedad Espanola de Construccion Naval. This is the first furnace of its kind, according to the builders, to be erected in Spain for converting their own natural ores in ferro-alloys.

THE CRYSTAL WASHING MACHINE COMPANY, Detroit, Mich., is being represented on the Pacific Coast by three organizations: in Oakland, Cal., for the State of California, by the West Coast Sales Company; for the State of Oregon, the Stubbs Electric Company of Portland, and for the State of Washington, the Western States Motor Supply Company of Seattle.

LOUIS C. EITZEN, formerly general manager of the August Mietz Corporation, is now associated with the Pittsburgh Filter & Engineering Company, with offices at 280 Broadway, New York City, as vice-president and general sales manager of the oil engine division. Since 1917 Mr. Eitzen has been general manager of the August Mietz Corporation, New York, builder of marine and stationary oil engines. For

LOUIS C. EITZEN

six years previous to that time he was sales and electrical engineer for the Standard Underground Cable Company of Pittsburgh, Pa. He has also been associated with the Electrical Testing Laboratories of New York City and the Bristol Instrument Company of Waterbury, Conn.

THE AMERICAN ELECTRIC FUSION COMPANY, Warren, Ohio, recently incorporated with a capital stock of $25,000, was organized to manufacture electrical apparatus for heating, melting and fusing. However, the company will devote its attention for the present to bringing out a new type of alternating-current arc welder.

ALLEN-BRADLEY COMPANY, Milwaukee, Wis., specialists in graphite compression resistance for controlling apparatus, announces the opening of a Buffalo office at 651 Ellicott Square, under the management of E. T. Cornell.

THE SOUTHERN STATES EQUIPMENT COMPANY is the new name adopted by the Southern States Electric Company, which organization also announces that its capital stock has been increased from $12,000 to $75,000.

THE ROBERTSON-CATARACT ELECTRIC COMPANY, electric supply jobbers, Buffalo, N. Y., has had plans prepared for the erection of a new building, six-story, of brick and reinforced concrete, at 128-30 South Elmwood Avenue. The structure will be about 45 x 115 feet, and is estimated to cost $100,000.

THE CHICAGO MICA COMPANY, Valparaiso, Ind., announces that at its recent annual meeting the following officers were elected: president, A. W. Pickford; vice-president, L. L. Fleig; secretary-treasurer, John F. Griffin. These gentlemen have taken over a majority interest in the company.

THE ELLIOTT-BLAIR STEEL COMPANY, Newcastle, Pa., has arranged for the building of a new plant at Mercer, Pa., to replace the one destroyed by fire some months ago. The company states that it will not be in the market for any machinery, boilers or engines as the plant will be operated entirely by electric power.

FRANK C. VAN ETTEN has resumed his position in the engineering department of the Delta-Star Electric Company, Chicago, Ill., after an absence of eighteen months in France where he has been connected with some of the largest installations in the A. E. F. as captain in the Ordnance Department.

THE ELECTRICAL REFRIGERATING COMPANY, INC., Consolidated Gas Building, New York City, reports that it has disposed of its entire supply of refrigerating machines for the current season. The company is planning to increase its facilities to an extent which will enable it to meet in the near future the large demand for these machines.

E. E. MAHER announces the formation of the Maher Engineering Company, with offices in the Michigan Boulevard Building, Chicago, to handle the sales and installation of Erie Engine Works high-speed engines, the Sims Company feed-water heaters, the Dayton-Dowd Company centrifugal pumps, Wagener Steam Pump Company pumps and Pratt Engineering & Machine Company's fertilizer and sulphuric-acid machinery.

THE H. F. KEEGAN COMPANY, First National Bank Building, Chicago, announces its appointment as district sales agent for the Van Dorn & Dutton Company, gear specialist, of Cleveland, Ohio. The company has also secured the sales agency of the Eureka Company of North East, Pa., manufacturer of a complete line of commutators, commutator bars, controller parts, line material, trolley wheels, brushholders and springs and bushings.

E. A. HITCHCOCK has recently become connected with the Bailey Meter Company of Cleveland, Ohio, as vice-president. He will supervise the training of technical graduates for the company's service and sales departments. During the past six years he has been connected with the E. W. Clark & Company Management Corporation as advisory, consulting and power sales engineer. Previous to that time he was professor of experimental engineering at Ohio State University.

THE CINCINNATI SPECIALTY MANUFACTURING COMPANY, INC., reports that the sale of the automatic extension reels for electric lamps, which it manufactures has been very large. The company, which was established in 1892 and did an extensive business in manufacturing metal goods under contract, began the manufacture of these reels a little over one year ago, and ever since, it states, it has been trying to produce enough reels to fill orders. The reel is handled by jobbers in all the principal cities in the United States, and several agencies have been established in Canada, South America and Europe. Branch offices have been opened as follows: W. S. Broadhurst, 39-41 Cortlandt Street, New York City; Cincinnati Specialty Manufacturing Co. of New England, 161 Massachusetts Avenue, Boston, and T. Tylers Boggs, 205 Abbott Building, Philadelphia.

THE EDISON STORAGE BATTERY COMPANY announces the election of Major Charles E. Sholes as vice president, director and general sales manager, succeeding Harrison G. Thompson, who has resigned to organize and conduct the Transportation Engineering Corporation of New York. Major Sholes has heretofore been identified with the construction, operation and management of chemical industries. He was the active member of the creditors' committee of the Aetna Explosives, Inc., during the receivership, which is ending. During the war he served as major in ordnance, first as chief of the chemical branch, and as army representative before the War In-

CHARLES E SHOLES

dustries Board, and numerous other committees and boards. He was subsequently made contracting officer for the United States on the staff of Colonel La Mont, and retains his rank in the officers' reserve corps. He is honorable chairman of the Society of Chemical Industry and a member of a number of other scientific societies.

THE CENTRAL STEEL COMPANY, Massillon, Ohio, has opened up new offices in Detroit, Mich., in the Book Building. Arthur Schaeffer, former assistant director of sales at the home office, Massillon, Ohio, has been appointed district manager of sales, with Frank Gibbons as his assistant. Mr. Gibbons, who has just joined the organization, has been associated with the Carbon Steel Company for five or six years where for the last several months he has been district sales manager of their Detroit office.

H. L. GARBUTT, for the last six years manager of the line material section of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been appointed manager of the supply division of the Westinghouse San Francisco office. In 1908 Mr. Garbutt became a part of the sales organization of the Drew Electric & Manufacturing Company of Indianapolis, handling various tpyes of overhead line material, with which company he remained until 1909, when he entered the supply department of the Chicago office of the Westinghouse company, as line material specialist. In this position he served until 1913, when he was made manager of the line material section, with offices at East Pittsburgh, Pa., serving in the capacity of manager until his recent promotion.

THE OHIO ELECTRIC & CONTROLLER COMPANY, 5900 Maurice Ave., Cleveland, Ohio, announces it has appointed as its representatives the following firms: The Iron & Steel Equipment Company, 1502 First National Bank Bldg., Pittsburgh, Pa.; Williams, Beasley Company, 343 So. Dearborn St., Chicago, Ill.; Linn O. Morrow, 707 Franklin Trust Bldg., Philadelphia, Pa.; J. W. Dopp & Company, 18 Columbia St., Detroit, Mich.; Kelly, Powell, Ltd., 403 McArthur Bldg., Winnipeg, Canada; Wonham, Bates & Goode, Inc., Dominion Express Bldg., Montreal, Canada; Shook & Fletcher Supply Company, Birmingham, Ala. For export business the following representatives have been appointed: Wonham, Bates & Goode, Inc., 17 Battery Pl., New York City, London, Paris, Havana and Rio de Janeiro; Mitsui & Company, 65 Broadway, New York, Japan, China, Philippine Islands, and Honolulu; Gustav Neilson A/S. Christiania, Norway, Sweden and Denmark.

THE BIJOU MOTOR APPLIANCE COMPANY, Fifteenth Street, Hoboken, N. J., manufacturer of electrical specialties, has leased for a long period one of the buildings in the Hoboken Terminal used by the government during the war and known as Building D. It will be used for specialty manufacture.

THE DUNBAR BROTHERS COMPANY of Bristol, Conn., manufacturer of springs, reports it is tearing down all the old buildings connected with its plant and replacing them with a large brick extension, which will be equipped with the latest appliances for the prevention of fire. The floor space will be materially increased when these additions are completed and the necessary machinery installed, which it is contemplated will be in about four months' time.

S. C. LYONS, electrical engineer, has recently returned from duty abroad with the Army Transport Service and has been appointed Eastern sales manager for the Art Metal Manufacturing Company, of Cleveland, manufacturer of commercial, industrial and residential lighting units. The company has opened an Eastern sales office and showrooms at 88 Park Place, New York City. Mr. Lyons was for a number of years identified with the sales department of the Consolidated Lamp Company and more recently with the Baily Electrical Supply Company of New York City.

FRANK H. SHUMAKER, who for the past eight years has covered northern Indiana and southern Michigan for the Illinois Electric Company of Chicago, has returned to his home city, South Bend, Ind., as secretary and general manager of the South Bend Electric Company. The new company is a one-hundred-thousand-dollar corporation, organized and controlled by R. P. Oblinger, I. D. Meek and H. E. Rasmussen of the Indianapolis Electric Supply Company. The business of the new company is the wholesale distribution of electric machinery and supplies throughout northern Indiana and southern Michigan.

THE KING-CRAYMER COMPANY, 1133 Broadway, New York City, the members of which have traveled for one of the large electrical manufacturing houses for many years, have now organized as agency representatives, located in New York, covering all the Eastern States, as far south as Virginia, for the following houses: Ajax Electric Specialty Company, St. Louis, Mo.; Multi Electrical Manufacturing Company, Chicago, Ill.; Commercial Enclosed Fuse Company, Hoboken, N. J., and Danbury Electrical Manufacturing Company, Danbury, Conn. The company is open for one or two good manufacturers' lines where the desire is to build up a good volume of business with the Eastern jobbers.

THE HOOVER SUCTION SWEEPER COMPANY broke ground on May 30 for a new two-story factory at Hamilton, Ont. It is expected that the new plant, which will have about 30,000 sq.ft. of floor space, will be ready for occupancy by Aug. 1. Through the Hamilton plant the Hoover Suction Sweeper Company of North Canton, Ohio, will market the company's products in Canada, Great Britain and the British Colonies. Both in Canada and Great Britain the Hoover suction sweeper sales have more than doubled in the past few years, and provision has been made for doubling the floor space of the new plant by adding two additional stories to take care of future growth of the business.

BERTRAM SMITH, assistant general sales manager of the Edison Storage Battery Company, Orange, N. J., has resigned to become president and general manager of the Automatic Electrical Devices Company, Cincinnati, Ohio. Mr. Smith's resignation is effective July 15. For more than twenty years Mr. Smith has been well known in the storage battery industry. At one time he was secretary and treasurer of the old National Battery Company, which marketed the "Sperry plate," and after the absorption of this company by the United States Light & Heating Company, he was for a number of years manager of the Western territory with headquarters at Chicago. In 1913 he resigned from this position to become assistant manager of the Edison Storage Battery Supply Company, with headquarters at San Francisco, and in 1915 was appointed manager of the Detroit sales district for the Edison Storage Battery Company, which position he occupied until September, 1918, when he received the appointment of assistant general sales manager with headquarters at Orange.

THE FORD MICA COMPANY, which is now occupying the entire building at 14 Christopher Street, New York City, announces that it has negotiations under way for the establishment of direct sales offices in London and Switzerland.

PAUL FIELDEN, credit manager of the E. W. Ham Electric Company, Worcester, Mass., addressed the Springfield Association of Credit Men on June 19 upon "Getting Together in New England." Mr. Fielden advocated closer co-operation among credit interests through the establishment of adequate records available for mutual service.

THE NORTH EAST ELECTRIC COMPANY, 348 Whitney Street, Rochester, N. Y., is understood to be planning for increased capacity in its plant for the manufacture of electric starting and lighting systems. The company is arranging plans for the erection of a new six-story plant, about 61 x 206 feet. H. W. Fowler is superintendent of construction.

F. W. MATHIEU, formerly designer with J. Livingston & Company, and E. F. Caldwell & Company, is now with the Mitchell Vance Company, Inc., 503 West Twenty-fourth Street, New York City. He will continue his work as designer, together with George V. Strahan. Mr. Mathieu has designed the lighting fixtures in many of the finest homes and public buildings throughout the country, among the latest being the Commodore Hotel, New York City; the El Condado Hotel, Porto Rico; La Salle & Koch Building, Toledo, Ohio, and many others of equal importance.

THE ELLIOTT-LEWIS ELECTRICAL COMPANY, electric supply jobber of Philadelphia, have been selected as distributers for the Blue Bird electric clothes washer, with exclusive territory for Philadelphia, and practically the full area it covers normally. The company is under contract to sell 11,000 of these washers the first year out of 125,000 that the manufacturers expect to produce. The Elliott-Lewis company is organizing a special staff to handle this appliance. This is probably one of the largest single merchandising enterprises that any electrical supply jobber has ever undertaken.

THE MILLIKEN BROTHERS MANUFACTURING COMPANY, Inc., Woolworth Building, New York, manufacturer of galvanized steel transmission towers, has organized the Milliken Manufacturing Syndicate, London, England, to handle all export trade, exclusive of North and South America. Offices have been established at Amberley House, Norfolk Street, Strand, with C. T. Wilkinson and F. Sumner-Smith in charge. To handle its western trade in this country, branch offices have now been established in the Majestic Building, Chicago, while to provide for Pacific Coast business a branch is now located in the Rialto Building, San Francisco.

Foreign Trade Notes

ELECTRIC FANS IN INDIA.—In Calcutta the Electric Supply Corporation has connected to its system more than 44,000 fans, 37,000 lights, and more than 1200 motors. The superiority of electric fans to the punkah-wallahs—coolies who work fans by hand—is being steadily appreciated. The municipal committee of Simla, the summer capital of India, is considering an extension of the existing electric plant there.

THE AMERICAN CHAMBER OF COMMERCE in France is making stronger efforts than ever to bring about close commercial and industrial relations between France and the United States. Among its various activities, one of considerable interest to American manufacturers is the publication of its "Fortnightly Information Review." The address of the Chamber is 32 rue Taitbout, Paris, France. Frank Boole is secretary.

EXPORT ASSOCIATION PLANS TO ASSIST FOREIGN BUYERS.—Arrangements have been made by the American Manufacturers' Export Association whereby introduction cards will be placed in the hands of foreign buyers about to visit this country. These cards, properly signed by representatives of the United States Government abroad, banks, chambers of commerce and the representatives of the Export Association in foreign lands, will serve to accredit visiting buyers to the New York office of the Export Association. Buyers seeking particular kinds of merchandise will thus be aided by the association in getting in touch with American manufacturers producing the kind of goods desired. This will result in putting foreign purchasers in direct touch with American exporters.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Electrical machinery and supplies are required by an industrial corporation (No. 29,684) in Italy. Correspondence may be in English.

Electric light sets and electrical accessories, lamps, fans, etc., are required by a firm in India (No. 29,653). General catalogs are requested.

A report by an English trade commissioner to Athens states that generators, motors and electric fittings are urgently required in Greece.

A company in England (No. 29,663), having recently established an office in this country, desires to communicate with manufacturers of electrical goods.

August Von den Eede, 57 rue de Virginal, Eulige, Belgium, wishes to represent American machinery manufacturers in Belgium. Terms are desired.

The representation of manufacturers of all kinds of electrical implements is desired by a commercial agent in Belgium (No. 29,717). Correspondence may be in English.

An agency is desired by a merchant in England (No. 29,581) for the sale in New Zealand of telegraph requirements, such as electric cables, and Gordon cells. Terms, cash against documents at destination.

Electrical supplies for light, heat, and power service, and for telephone and telegraph service, are required by a firm in Norway (No. 29,748). Payments to be through New York and Norwegian banks.

An agency is desired by a manufacturer in Spain (No. 29,784) for the sale of cranes, elevating apparatus, electric motors, generators and electrical apparatus and supplies. Correspondence should be in Spanish.

C. B. Thompson & Company, 9 Crooked Lane, Calcutta, electrical and mechanical Engineers, write "We hope to do a good deal of trading with the United States, and are looking for a suitable agent in the electrical-mechanical line."

The purchasing agent (No. 29,711) of a firm having large department stores in several different countries is in the United States and wishes to purchase for immediate delivery electrical goods. Payment, cash, or terms suitable to seller.

A firm in Belgium (No. 29,656) desires to purchase or act as agent or receiver on consignment of electric railway equipment, traveling cranes, electrical material, motors, illuminating and insulating material, and telephone and other special equipment.

The agency and purchase of telephones, wiring devices, Edison and bayonet lamp holders, shade holders, switches, bells, plugs, brass and porcelain sockets, connecting sets, fans and other electric supplies are desired by a man in Italy (No. 29,590). Correspondence may be in English.

The purchase of tubing for high pressure turbines and electrical machinery of all kinds for developing waterfall power is desired by a firm (No. 29,741) in a consular district of Spain. Quotations should be given f.o.b. New York. Terms, cash against documents. Correspondence may be in English.

Leon K. Parounaghian, 89 Rue d'Eglise, Makri-keuy, Constantinople, Turkey, mechanical and electrical engineer from the Ecole Polytechnique of Paris, France, has opened an office at Constantinople, Turkey, and desires to get in touch with electric and mechanical corporations which deside representation in Turkey.

The municipality of a city in Greece (No. 29,759) desires to receive proposals until September 11, 1919, for the installation and operation under contract for a period of years, of an electrical plant to furnish light and power to the city and its surroundings. Further information and terms of contract may be had on application to the bureau or its district offices.

New Incorporations

THE S. & S. ELECTRICAL COMPANY of Brooklyn, N. Y., has been incorporated by George Bryant, Samuel Sternlies and Benjamin Posner, 854 Myrtle Avenue, Brooklyn, N. Y. The company is capitalized at $3,000.

THE ELECTRICAL REPAIR & ENGINEERING COMPANY of Cleveland, Ohio, has been chartered with a capital stock of $10,000 by Emanuel Levison, Clementine Levison, Robert I. Grossman, Harry J. Kortz and F. M. Kortz.

THE GARRETT ELECTRIC LIGHT & POWER COMPANY of Winchester, Ohio, has been incorporated by C. O. Garrett, A. D. Kirk, O. W. Knechtly, F. S. Wasson, Charles Solomon and James Rea. The company is capitalized at $100,000.

THE KEOKUK WATER POWER LIGHTING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $400,000. The incorporators are: M. L. Rogers, L. A. R. Irwin and H. W. Singe of Wilmington, Del.

THE MULTI-WIND POWER & ELECTRIC COMPANY has filed articles of incorporation with a capital stock of $50,000 to manufacture and deal in windmills, generators, etc. The incorporators are Elmer W. Gragert, August E. Johnson, both of Minneapolis, Minn., and Marvin A. Gragert of Bordulac, N. D.

THE LEON ELECTRIC SUPPLY COMPANY of Tallahassee, Fla., has been incorporated with a capital stock of $6,000 to manufacture and deal in electrical and gas machinery, supplies, etc. The officers are: Richardson O. Collins, president; E. N. Oliver, vice-president, and Charles Williams, secretary and treasurer.

THE CHALLANGE STORAGE BATTERY CORPORATION of New York, N. Y., has been incorporated by S. Apostoloff, G. Apostoloff, 123 Manhattan Avenue, New Cork City, and G. B. Davis of Poughkeepsie, N. Y. The company is capitalized at $50,000 and proposes to do a general electrical and mechanical engineering business.

THE INTERNATIONAL POWER COMPANY has filed articles of incorporation with a capital stock of $100,000 for the purpose of generating and distributing electricity in the city of Calais, the towns of Baring and Baileyville. The officers are: George A. Curran of Calais, president; Ben I. Curran, treasurer and clerk of Calais.

THE A. C. ELECTRICAL MANUFACTURING COMPANY of Dayton, Ohio, has been incorporated with a capital stock of $100,000 by R. Harry Crowingshield and others.

THE CENTRAL POWER & LIGHT COMPANY of Mineral Wells, Tex., has been incorporated with a capital stock of $250,000 by Ira J. Kerr, Roy R. Poe and M. B. Milburn.

THE SERVICE ELECTRIC SUPPLY COMPANY of Stockton, Cal., has been incorporated with a capital stock of $100,000 by C. E. Condit, Benjamin R. Van Cott and M. B. Rinehart.

THE GUILFORD STORAGE BATTERY COMPANY of Greensboro, N. C., has been incorporated with a capital stock of $25,000 by J. U. Lindsay, G. L. Spencer, and C. M. Crawford all of Greensboro, N. C.

THE SWARTZ ELECTRIC COMPANY of Dayton, N. H., has been incorporated by C. H. Swartz and George T. Schneidler with a capital stock of $15,000 to deal in electrical appliances, electric lighting fixtures, etc. The store will be located at 40 East Fourth Street, Dayton.

THE POWER SECURITIES COMPANY of Concord, N. H., has been incorporated with a capital stock of $27,500,000 by Thomas Hollis, Joseph W. Worthen and Robert C. Murchie of Concord. The company proposes to operate electric and gas plants and water works systems, etc.

THE WETHLING-BAKELY COMPANY of Orange, N. J., has been incorporated by Edward Bakely of Livingston, and H. D. Wethling and A. D. Seymour both of Orange, N. J. The company is capitalized at $100,000 and proposes to manufacture and deal in electrical appliances, etc.

THE MULTIPLE ELECTRIC PRODUCTS COMPANY of New York, N. Y., has been chartered by J. H. Wallace, 54 Landscape Avenue, Yonkers; E. Frankel, 700 West 179th Street, New York City, and Andrew C. Knoeller, Jersey City, N. J. The company is capitalized at $250,000 and purposes to deal in electrical apliances.

THE ROOT ELECTRIC SIGN COMPANY of Lockport, N. Y., has been incorporated by F. A. Root, 283 East Avenue; A. L. Hoar, 223 Genesee Street, and C. F. Metzger, 362 East Avenue, Lockport. The company is capitalized at $200,000 and proposes to manufacture and deal in electrical signs.

THE MATTHEW ENGINEERING & CONTRACTING COMPANY of Ulster County, N. Y., has been chartered with a capital stock of $50,000 to do a general engineering and electrical contracting business. The incorporators are: Edw. A. Brown, Hyman Orleen and Jack Meyer, 192 Broadway, New York City.

THE GENERAL COMBUSTION COMPANY OF CANADA, of Montreal, Que., has been incorporated by Milton A. Hesey, Henry H. Vaughn, Walter A. Janssen and others. The company is capitalized at $100,000 and proposes to manufacture electric furnaces, electric heating devices, blowers, conveying equipment, etc.

Trade Publications

ELECTRIC REFRIGERATORS. — The Utility Compressor Company, 355 Harper Avenue, Detroit, Mich., is distributing a leaflet covering its new line of electric iceless refrigerators.

OIL ENGINES.—Heavy duty oil engines for station or marine service are the subject of 18-page bulletn O. E. 20 available from the Pittsburg Filter & Engineering Company, Pittsburg, Pa.

PORTABLE MOTOR-DRIVEN DRILLS. —The Stow Manufacturing Company of Binghamton, N. Y., illustrates and gives dimensions of its portable electric drills in a recently issued circular.

ELECTRIC DRINK MIXERS. — Two models of electric drink mixers are the subject of an illustrated circular prepared for dealers' distribution by the Hamilton-Beach Manufacturing Company of Racine, Wis.

THREE-HEAT ELECTRIC IRON.—The Redtop Electric Company, 8 West Nineteenth Street, New York City, has prepared a circular about its new "Everhot" three-heat electric iron equipped with a heat regulating plug.

DRINK MIXERS AND BEVERAGE HEATERS.—The H. B. Gibson Company, 123 Liberty Street, New York City, is distributing a number of circulars about its "twin electric drink mixer" and its "Thermovac" individual-drink electric heater.

GAS AND AIR MEASUREMENT.—The Cutler-Hammer Manufacturing Company of Milwaukee, has prepared a 16-page booklet entitled, "The Value of the Accurate Measurement of Gases and Air—In Gas Plant—Coke Oven Plant—Steel Plant—Chemical Plant."

CONSTRUCTION MACHINERY.— Chris D. Schramm & Son of Philadelphia have prepared illustrated general catalog No. 18 covering electrically-driven labor-saving machinery for construction work, road building, ship yards, railroad and municipal improvements, etc.

New England States

MANCHESTER, N. H.—The committee appointed by the Board of Aldermen has recommended the installation of 90 lamps erected on oramental brackets attached to the trolley poles on Elm Street. Street lighting service is furnished by the Manchester Traction, Light & Power Company.

NEW BEDFORD, MASS.—The municipal hospital building committee is considering the installation of an electric power plant, to cost between $20,000 and $25,000, in connection with the municipal hospital. The R. D. Kimball Company has charge of the engineering work of the proposed hospital.

QUINCY, MASS.—The coal hoisting apparatus at the local power house of the Bay State Railway Company was recently damaged by fire causing a loss of about $15,000.

SALEM, MASS.—The Salem Lighting Company has increased its capital stock from $150,000 to $300,000.

PAWTUCKET, R. I.—The Potter & Johnston Machine Company, Newport Avenue, is planning to install a power plant to supply electricity to operate its works.

PROVIDENCE, R. I.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 31, for remodeling an electric passenger elevator in the United States post office, court house and custom house at Providence.

WESTERLY, R. I.—Bids will soon be received by Bilderbeck & Langdon, engineers, Barrows Building, New London, Conn., for the erection of a factory, 130 ft. by 300 ft., and a power house, 30 ft. by 40 ft., both one story high, for the Rhode Island Silk Company at Westerly, to cost about $120,000.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

MERIDEN, CONN.—The H. E. Rainaud Company, 135 Jackson Street, Newark, N. J., it is reported, is planning to remove its works to Meriden, Conn., where it will occupy the former plant of the J. D. Bergen Company. The Rainaud company manufactures electric reading lamps.

NEW LONDON, CONN.—The Public Utilities Commission has granted the Connecticut Power Company permission to erect an electric transmission line in New London, 1600 ft. in length.

Middle Atlantic States

BALLSTON SPA, N. Y.—The installation of an ornamental street lighting system is under consideration by the Board of Trustees. The Adirondack Electric Power Corporation of Glens Falls has the contract for street lighting.

BINGHAMTON, N. Y.—Plans are under consideration by the Binghamton Light, Heat & Power Company for improvements to its plant, to cost about $200,000.

BINGHAMTON, N. Y.—The Larrabee-Deyo Motor Truck Company is considering an addition to its plant, to cost with equipment about $200,000. E. M. Hanrahan is general manager.

BUFFALO, N. Y.—Plans have been prepared by the Robertson-Cataract Electric Company, West Mohawk Street, for the erection of a new building, six stories, 45 ft. by 115 ft., to cost about $100,000.

CARTHAGE, N. Y.—The local substation of the Northern New York Utilities, Inc., of Watertown was recently damaged by fire, causing a loss of about $15,000. The switchboard, transformers, instruments, etc. were damaged.

ITHACA, N. Y.—Bids will be received by C. D. Bostwick, comptroller, Cornell University, Ithaca, until July 24 for construction, including heating and electric work, of laboratory for economic investigations of insects at the New York State College of Agriculture, Cornell University. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany. L. F. Pilcher, Capitol, Albany is architect.

LONG ISLAND CITY, N. Y.—The Lauraine Magneto Company, 1765 Broadway, New York City, is erecting a plant on Thirteenth Street, rear Van Alst Avenue, to cost about $125,000.

LOWVILLE, N. Y.—Surveys are being made by the Northern New York Utilities, Inc., of Watertown, for the erection of a high-tension transmission line from its power house at Belfort to Lowville, a distance of 20 miles. H. G. Davis of Watertown is chief engineer.

OSWEGO, N. Y.—The City Council has adopted a resolution authorizing the sale of $345,000 in bonds, the proceeds to be used for the construction of a power house at Dam No. 6.

NEWARK, N. J.—Plans are being prepared by Helme & Corbett, 190 Montague Street, Brooklyn, New York, N. Y., for the erection of a new manufacturing plant, 260 ft. by 275 ft., six stories Peddie Street, near Hillside Avenue, for the L. E. Waterman Company, 191 Broadway, New York, N. Y. The company manufactures fountain pens.

PHILLIPSBURG, N. J.—Extensive improvements are contemplated to the street lighting system. A movement has been started to erect lamp standards on South Main Street from Jersey Street to Jefferson Street.

ALTOONA, PA.—Plans for the proposed addition to the Le Roy Hotel on Chestnut Avenue, provide for the installation of an electric power plant.

NEW FREEDOM, PA.—The Borough Council is considering the question of purchasing electricity to operate the municipal electric system from the Glen Rock (Pa.) Electric Power Company, which secures its power from the York Haven (Pa.) Power Company.

TITUSVILLE, PA.—The Titusville Light & Power Company has filed notice of an issue of $15,000 in bonds with the Public Service Commission, the proceeds to be used for expansion.

ZELEINOPEL, PA.—The Universal Rubber Company, it is understood, will use a large amount of electrical equipment in connection with the construction of its proposed new plant. The cost of the entire plant is estimated at about $300,000.

BALTIMORE, MD.—The plans for the proposed machine shop to be erected on Hanover Street for the Standard Oil Company, include an engine house and pumping unit. The cost is estimated at about $40,000.

SALISBURY, MD.—Notice has been filed with the Secretary of State by the Eastern Shore Gas & Electric Company of an increase in capital stock from $750,000 to $1,150,000.

CLENDENIN, W. VA.—The Kanaelk Coal Company is planning to build a power station, etc. W. W. Whyte is president.

LEXINGTON, VA.—The installation of two 500-hp. boilers at the Virginia Military Institute is under consideration. The cost is estimated at $15,000. Carneal & Johnston, Chamber of Commerce Building, Richmond, Va., are engineers.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Room 511, District Building, until July 28 for furnishing one switchboard for the Rock Creek pumping station. Specifications and necessary information may be obtained from the chief clerk, Engineer Department, Room 427, District Building.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 18 for furnishing at Mare Island, Cal., under schedule 4196, two motor-generator sets. Until July 25, various yards, under Schedule 4195, globes, Brooklyn, N. Y.; Schedule 4194, special strain insulators. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 25 for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C., Schedule 4185—600 storage batteries. Newport, R. I., Schedule 4186—25,000 ft. double-conductor cable. Brooklyn and Mare Island, Schedule 4190—miscellaneous shaft indicator system and indicator turbine system. New Orleans, Schedule 4197—two switchboards. Applications for proposals should designate the schedule desired by number.

North Central States

DETROIT, MICH.—A special election will be held July 22 to submit to the voters the proposal to issue bonds, not to exceed $10,000,000, for construction and maintenance of a municipal railway system.

LANSING, MICH.—The City Council has called a special election to be held July 26 to vote on bond issue totaling $788,000, of which $350,000 is for extensions to the municipal electric light system, $300,000 for waterworks extensions, $100,000 for detention hospital, and $38,000 for an addition to Mount Hope Cemetery.

ASHLAND, OHIO.—Bids will be received at the office of the director of public safety, City Building, Ashland, Ohio, until July 22, for construction of a filtration plant of 1,500,000 gal. capacity and auxiliary pumping station, with pumping equipment and all necessary appurtenances. Copies of plans and specifications may be obtained at the office of the director of public service Ashland, or at the office of R. Withrop Pratt, Hippodrome Building, Cleveland, Ohio, upon deposit of $15.

CANTON, OHIO.—The Canton Feed & Milling Company it is reported, is contemplating the erection of a new flour mill, to cost about $200,000, to be equipped throughout with electrical operated machinery.

CINCINNATI, OHIO.—The City Council is considering the installation of an ornamental lighting system on Hamilton Avenue.

CINCINNATI, OHIO.—Work will soon be started by the Cincinnati Traction Company on the erection of a high-tension transmission line from the Pendleton station on Eastern Avenue to the Hyde Park car barns for the purpose of supplying energy to operate the Madisonville street car line.

CLEVELAND, OHIO.—Contract has been placed by the General Electric Company for the erection of a four-story factory, 112 ft. by 300 ft., for the manufacture of incadescent lamps, to the S. W. Emerson Company, Cleveland.

HAMILTON, OHIO.—An electric power plant, it is understood, will be installed at the Rockdale dam to furnish energy for the Hamilton Furnace Company, which is planning to double the output of its plant.

OBERLIN, OHIO.—Another special election will be held on Aug. 12 to vote on the proposal to issue $50,000 for the installation of a municipal electric light plant. The bonds were authorized by a decisive vote on May 27, but to avoid a litigation by the Oberlin Gas & Electric Company it has been decided to hold another election.

PAINESVILLE, OHIO.—A new steam turbine has been purchased for the municipal electric light plant.

TOLEDO, OHIO.—The sawmill of the Fisher-Storey Company, recently destroyed by fire, will be rebuilt. The plant will be equipped with electric motor-driven machinery. Energy will be generated by a plant to be installed in connection with the proposed mill.

WEST ELKTON, OHIO.—The Ohio Gas & Electric Company of Middle town has applied to the Village Council for a franchise to establish and operate an electric light and power system in West Elkton.

ASHLAND, KY.—Bids will be received by the Board of Water Cmomissioners at the office of the water works until July 24 for the construction of a pumping station and filtration plant, as follows: (1) Structures, including coagulating and clear water basins and station building; (2) filtration equipment, 2,000,000 gal. daily capacity; (3) centrifugal pumping equipment, seven units; (4) 35,000-gal. wash water tank; (5) Venturi meter; (6) cast-ironpipe and fittings; (7) valves. Plans and specifications are on file at the above office and at the office of Alvord & Burdick, engineers, Hartford Building, Chicago, Ill.

SPRINGFIELD, KY.—The Springfield Water & Electric Company is planning to change its system from direct to alternating-current system and to install switchboard panels, alternators, engines, etc. H. W. Mayfield, 298 West Oak Street, Ludlow, is engineer.

BLUFFTON, IND.—The City Council is considering improvements to the municipal electric light plant, to cost about $15,000. It is proposed to replace the 400-kw. Corliss engine in the plant with a 1000-kw. turbine.

CLAY CITY, IND.—The plant of the Clay City Lighting Company has been purchased by the Wabash Valley Light & Power Company and will be taken over and operated as part of the latter company's system. Electrcity for the local system will be supplied from the Sullivan plant of the Wabash Valley company.

FORT WAYNE, IND.—A new air compressor, having a capacity of 2700 sq.ft. per minute, will be installed at the local power plant of the Pennsylvania Railroad Company.

HAMMOND, IND.—Bids, it is reported, are being asked by Edward D. Shank, architect, First National Bank Building, Chicago, Ill., for the erection of a plant for the Railway Motor Company of America in Hammond. The proposed works will consist of three large buildings and a power house, 40 ft. by 75 ft.

INDIANAPOLIS, IND.—Contract, it is reported, has been awarded by the Nordyke & Marmon Company for the construction of two new factory buildings, one five stories, 80 ft. by 600 ft., the other 100 ft. by 800 ft., one story. A power plant, dry kiln and planing mill are also included in the plans. The extensions will be used for the manufacture of automobile bodies and as an assembling department.

LOGANSPORT, IND.—A petition has been presented to the City Council asking for the installation of a new street lighting system.

CHICAGO, ILL.—The Vitanola Talking Machine Company is planning to erect a plant on South Fifty-second Avenue, south of Nineteenth Street, to cost about $500,000.

GRANVILLE, ILL.—The Putnam County Electric Company has petitioned the Public Utilities Commission for permission to construct and operate electric lighting plants and distribution systems in the villages of Florid, Mount Palatine and Cedar Point, and to extend its electric transmission line a distance of 5 miles from the present terminus.

MOUNT AUBURN, ILL.—The Wurl Electric Company has applied for permission to install and operate an electric lighting system in Mount Auburn. The company has also asked for authority to issue $5,000 in capital stock.

PALMYRA, ILL.—The State Utilities Commission has granted the Palmyra Light, Heat & Power Company permission to erect an electric transmission line from Palmyra to Waverly and to Modesto. The company will supply electricity to residents along the route. Authority was also given the company to issue $8,000 in capital stock. Lewis M. King is president.

APPLETON, WIS.—The Wisconsin Traction Company is contemplating extending its system to nearby towns. Work has commenced on the extension to Hortonville.

DE PERE, WIS.—Plans are being prepared by L. A. DeGuere, Consulting engineer, Grand Rapids, Mich., for the erection of a new plant in De Pere for the George Diamond Economy Process Company of Milwuakee for the manufacture of machines for making paper boxes, to cost about $750,000. The proposed plant will include a 60-ton paper mill, a machine shop, boiler house, finishing room and warehouse. George Diamond is vice-president and general manager.

FOND DU LAC, WIS.—Contracts, it is understood, will soon be awarded by the Lotex Tire Company for the construction of the first unit of its new plant, consisting of a building, 45 ft. by 200 ft., with separate boiler house and power plant, 80 ft. by 80 ft. B. E. Mehner is architect.

GREEN BAY, WIS.—A special committee has been appointed to make investigations relative to the installation of a new street lighting system. Cecil Baum is a member of the committee.

MADISON, WIS.—Plans prepared by Fred L. Kronenberg, architect, Madison, for the proposed vocational training institute, to cost about $300,000, have been accepted by the joint building committee of Madison, Board of Education and Board of Industrial Education. Bids for construction, it is understood, will be asked for in the near future.

MALONE, WIS.—The Malone Light & Power Company, recently organized with a capital stock of $25,000, is planning to build an electric plant in Malone. John L. Beau, Frank Clark and others are interested in the company.

RACINE, WIS.—The Hamilton-Beach Manufacturing Company of Racine, it is reported, is planning the establishment of a branch manufacturing plant in New England, the location still to be determined. The company manufactures electrical goods, electric motors, etc.

SOUTH BYRON, WIS.—Plans are being prepared for the installation of an electric lighting system in South Byron. Electricity for operating the system will be obtained from the plant at Kilbourne.

ST. JOSEPH, MINN.—Plans are under consideration by Utz & Fitzpatrick for the construction of a new plant for the manufacture of electric batteries, to cost about $10,000.

DAVENPORT, IOWA.—Property owners on Perry Street between Second and Third Streets are contemplating the installation of ornamental lamps, to cost about $2,500.

MANSON LAKE, IOWA.—The property of the Manson Electric Light & Power Company has been purchased by Guy Mack and Major Frank Mack, both of Storm Lake.

STORM LAKE, IOWA.—An election will soon be held to submit the proposal to issue $100,000 in bonds for the installation of a municipal electric light plant in Storm Lake.

TRAER, IOWA.—An election will be held in July to submit to the voters the proposal to issue $50,000 bonds to establish a municipal electric light plant.

FULTON, MO.—Contract has been awarded for the construction of a power house and heating plant at Westminster College to Oscar Thomas of Sedalia. The cost is estimated at $30,000.

ST. LOUIS, MO.—The National Barium & Chemical Company is contemplating the erection of a new plant, including a power plant, administration building, etc.

MADISON, S. D.—Bids will be received by the City Commissioners of Madison until July 28 for furnishing machinery and equipment for the municipal electric light plant, including two 250-hp. Diesel oil engines, directly connected to two 210-kva., three-phase, 60-cycle, 2300-volt generators, with directly connected exciters; one 25-kw. motor-driven exciter, one switchboard complete, consisting of two exciter panels, three generator panels, two feeder panels, one street lighting panel with all necessary busses, switches, instruments, etc. Plans and specifications may be obtained at the office of William Rae, city auditor, or at the office of Charles A. Trimmer, consulting engineer, Madison, upon deposit of $10.

NEWELL, S. D.—Contract will soon be awarded by the city of Newell for construction of water works system, including storage water reservoir, water softening plant, power plant, steel water storage tank and tower, water distributing system, etc. W. C. Buck, 1245 West Minnehaha Parkway, Minneapolis, Minn., is consulting engineer.

OMAHA, NEB.—The Nebraska Power Company has issued $5,600,000 in bonds. Of the proceeds $2,000,000 will be used to take up outstanding bonds, and the remainder for extensions and improvements.

ARCADIA, KAN.—The local electric light plant, it is reported, was recently destroyed by a storm.

ELKHART, KAN.—Extensions and improvements to the municipal electric light plant and water works system, to cost about $60,000, are under consideration.

LARNED, KAN.—The Pawnee Power & Water Company is contemplating the construction of a substation to supply energy for its proposed transmission line.

TOPEKA, KAN.—Plans are under consideration by Commissioner Stanfield for consolidating the electric light plant with the waterworks plant. It is proposed to install a new generator in the water plant to enable it to carry the electric light load after midnight.

WASHINGTON, KAN.—The installation of a municipal electric light plant in Washington is under consideration.

Southern States

GREENSBORO, N. C.—Plans are under consideration by the City Commissioners for the installation of an ornamental lighting system on Elm Street.

MAXTON, N. C.—The installation of an electric light plant and water works system in Maxton is under consideration by the Town Board.

ORANGEBURG, S. C.—The City Council is considering calling an election to submit to the voters the proposal to issue $70,000 in bonds for extensions to the municipal electric power plant, including the installation of new machinery. The installation of an oramental lighting system is also under consideration. J. W. Hawes of Orangeburg is engineer.

MC DONOUGH, GA.—The development of a water power at Peachstone Schools and furnishing electricity for lamps and motors in Locust Grove and Stockbridge is under consideration by Dr. A. R. Scott.

ST. GEORGE, FLA.—Plans are being prepared by the St. George Co-operative Colony, 506 Clak Building, Jacksonville, recently organized, to establish a sea-food canning and refrigerating plant. The project will include the erection of various buildings, installation of an electric light and power system, waterworks, bakery, laundry and button factory. W. W. Anderson is president.

ENTERPRISE, ALA.—The city of Enterprise has entered into a contract with the Georgia-Alabama Power Company to furnish electricity to the city from its proposed plant to be erected on the Pea River near Elba. The cost of the plant is estimated at $200,000 and the transmission line about $100,000.

EUFAULA, ALA.—Arrangements have been made between City Council and the Foy-Shemwell Power Company, whereby the latter will take over the municipal electric light and gas plants. The gas plant it is understood will be rebuilt.

YAZOO CITY, MISS.—Extensions and improvements are contemplated to the municipal electric light plant.

HOMER, LA.—The City Council is planning to rebuild the municipal electric light plant. Xavier A. Kramer of Magnolia, Miss., is consulting engineer.

NEW ORLEANS, LA.—New equipment will be installed at the power house at the Charity Hospital, including a 300-kw. three-wire, direct-current generator (directly connected), steam engines, motors, etc. An underground system will be constructed to distribute electricity from the power station (already completed) to about 20 buildings. The total cost of the work is estimated at about $90,000. A. Wyndham Lewin, 335 Carondelet Street, is consulting engineer.

BARTLESVILLE, OKLA.—The Empire Oil & Gas Company is planning to install electrically-operated equipment for drilling oil wells in the Texas fields. About 700 motors, it is understood, will be required.

FREDERICK, OKLA.—Bonds to the amount of $40,000 have been voted for the installation of ornamental lamps on certain streets, extensions of the light and power service to the district of the city previously deprived of service.

PAWHUSKA, OKLA.—An election will soon be held to submit to the voters the proposal to issue $67,567 in bonds for improvements to the municipal electric light plant, $283,093 for extensions to waterworks and $79,380 for improvements to sewerage system.

ABILENE, TEX.—The proposed dam which the city of Abilene is to build on Elm Creek, 16 miles from here, will create a water storage reservoir from which the municipal supply will be obtained, and the surplus will be used for irrigating a large acreage of valley land. The plans also include the construction of a hydroelectric plant. The cost of the entire project is estimated at about $500,000.

CANTON, TEX.—A deal, it is reported, has been consumated by which a syndicate of Eastern men will build an electric generating station near Canton, to cost, including electric transmission lines extending to cities and towns within a radius of about 150 miles, about $2,000,000. Lignite will be used for fuel. M. G. Saunders president of the Chamber of Commerce of Canton, may be able to give further information.

FORT WORTH, TEX.—The installation of a municipal electric light plant in Fort Worth is under consideration.

SHERMAN, TEX.—The City Commission is considering plans submitted by Jack Ellington, city manager, for the construction of a municipal electric light and power plant. The cost is estimated at about $630,000.

WACO, TEX.—Petitions are being circulated calling for the establishment of a municipally owned gas and electric light plant.

Pacific and Mountain States

ABERDEEN, WASH.—Arrangements are being made by the Hoquaim Sash & Door Company to rebuild its factory, recently destroyed by fire, on an enlarged scale. The cost is estimated at $200,000.

TACOMA, WASH.—An ordinance has been introduced in the City Council calling for a special election to vote on the proposal to issue $300,000 in bonds for the purchase of the Lake Cushman power site.

FRESNO, CAL.—The State Railroad Commission has authorized the San Joaquin Light & Power Company to issue $1,000,000 in bonds, to be sold at not less than 88. Of the proceeds $512,934 is to be used to take up outstanding indebtedness and the remainder to pay for extensions and improvements listed with the commission.

HOLLISTER, CAL.—The installation of an electrolier lighting system is under consideration by the City Trustees. A. M. McCray is city engineer.

ONTARIO, CAL.—The State Railroad Commission has granted the Ontario Power Company permission to issue $12,000 in bonds with which to complete its hydro-electric power plant in San Antonio Canyon.

SACRAMENTO, CAL.—Plans are being prepared by R. A. Harold, architect, Forum Building, for the construction of a two-story service building and power house on the County Hospital grounds, to cost about $100,000.

SOUTH SAN FRANCISCO, CAL.—Bonds to the amount of $10,000 have been voted for the installation of a fire alarm system.

TRACY, CAL.—An election will soon be called to vote on the proposal to issue $10,000 in bonds for the purchase of electroliers.

DRUMMOND, IDAHO.—The installation of an electric lighting system in Drummond is under consideration. It is proposed to purchase energy to operate the proposed system. About $8,000 has been subscribed toward the project.

SACATONE, ARIZ.—The erection of a 11,000-volt transmission line from Sacatone to the State Penitentiary at Florence, a distance of 25 miles, is under consideration. The cost is estimated at about $50,000. T. Maddox is state engineer.

LAVINA, MONT.—The installation of an electric lighting system in Lavina is under consideration. Energy to operate the proposed system will be obtained from the transmission system of the Montana Power Company.

SILDIX, MONT.—The Amazon-Dixie Mining Company is contemplating the installation of an electric power plant in the near future. Energy may be secured from the power plant in Mullan, Idaho, 11 miles distant. Sildix has not a post office.

HUGO, COL.—The Lincoln Light & Power Company has petitioned the State Utilities Commission for a certificate of public convenience and necessity authorizing it to supply electricity in the town of Hugo and vicinity.

Canada

ALEXANDRIA, ONT.—Investigations are now being made with a view of serving the town of Alexandria and the village of Lancaster with hydro-power from the St. Lawrence system.

BRAESIDE, ONT.—The local electric plant owned by Gillies Brothers, Ltd., together with lumber mill, was recently destroyed by fire, causing a loss of about $150,000. The company, it is expected, will rebuild immediately.

KAPUSKASING, ONT.—The Spruce Falls Pulp & Paper Company is contemplating the construction of a pulp mill near Spruce Falls, on the Kapuskasing River. The project includes a hydro-electric power development with an initial output of 9000 hp. and an electric transmission line, 8 or 9 miles long, to the mill. The company is capitalized at $6,000,000. E. Stewart, managing-director of the Canada Timber and Lands, Ltd., Standard Reliance Building, King Street, Toronto, is reported to be interested in the project.

MANSFIELD, ONT.—The Galetta (Ont.) Electric Power & Milling Company is planning to erect a transmission line from its plant to Mansfield.

WINGHAM, ONT.—The City Council is considering securing energy from the Hydro-Electric Commission of Ontario to operate the municipal electric light and power system. A. Flint, 190 University Avenue, Toronto, is engineer. For further information address J. F. Groves of Wingham.

MONTREAL, QUE.—The Scott Canadian Magnesite Company, Power Building, is contemplating the erection of industrial buildings on Shawinigan Street, to cost about $350,000.

MONTREAL, QUE.—Bids will be received by the Lignite Utilization Board of Canada, 80 St. Francois Xavier Street, Montreal Que., until July 23 for coal-crusher and until July 30 for coal-drying equipment. Specifications and full information may be obtained on application to the secretary of the board upon deposit of $2. Leslie R. Thomson is secretary.

MONTREAL, QUE.—The Board of Utilization of Canada, 80 St. Francois Xavier Street, Montreal, may be in the market in the near future for the following power house equipment: (A) Three 125-hp. horizontal return tubular boilers, with usual fittings for 125 to 150 lb. steam pressure, suitable for suspension setting. (B) One steam-driven boiler feed pump, suitable for the above boilers. (C) Two 200-kva. 550-volt, three-phase, 60-cycle engine-driven generating units, directly connected or belted, non-condensing, with exciters or equivalent direct-current apparatus. (D) One 10-kva., three-phase, 60-cycle, 110-volt gasoline or oil engine-driven emergency lighting set, directly connected or belted, with exciter or equivalent direct-current apparatus. (E) One Standard Underwriters' steam fire pump, capacity 1000 U. S. gal. per minute, 125 to 150 lb. steam pressure. The board will consider used equipment, provided it is in good condition and otherwise suitable. The requirements as outlined above are not rigid and sellers are invited to submit to the board descriptions and prices of apparatus which conform in general thereto. Leslie R. Thomson is secretary of board.

(Issued June 24, 1919

1,307,342. IGNITER; Phelps Brown, Springfield, Mass. App. filed Oct. 2, 1918.

1,307,343. IGNITER; Phelps Brown, Springfield, Mass. App. filed Oct. 24, 1918.

1,307,369. INTEGRATING MECHANISM; Edwin H. Messiter, Brooklyn, N. Y. App. filed Sept. 20, 1917. Automatic weighing machine.

1,307,385. X-RAY TUBE HOLDER AND SHIELD; Harry F. Waite, New York, N. Y. App. filed Sept. 20, 1917.

1,307,386. FILM-HOLDER FOR X-RAY APPARATUS; Harry F. Waite, Whitestone Landing, N. Y. App. filed Nov. 1, 1917.

1,307,407. CELL-PLATE; Teijiro Majima, Hyogo-Ken, Japan. App. filed Oct. 11, 1918. Weight reduced.

1,307,455. VACUUM ELECTRIC APPARATUS; Joseph C. Pole, New York, N. Y. App. filed June 19, 1913.

1,307,456. PORTABLE ELECTRIC LIGHT; Lester Prahar, N. Y. App. filed July 24, 1917.

1,307,489. TELEPHONE-EXCHANGE SYSTEM; Alfred H. Dyson, Montclair, N. J. App. filed June 7, 1915.

1,307,507. HIGH-POTENTIAL CONDENSER; David T. May, New York, N. Y. App. filed Nov. 3, 1917. Relieves concentration of the stress near the edges of the plates.

1,307,510. THERMIONIC TRANSLATING DEVICE; Alexander McLean Nicolson, N. Y. N. Y. App. filed Apr. 16, 1915.

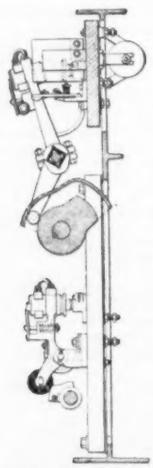
1,307,511. ELECTRIC-WAVE-REPEATING APPARATUS; Alexander McLean Nicolson, New York, N. Y. App. filed Oct. 26, 1916. Audion.

1,307,517. RECTIFIER; Paul M. Rainey, Glen Ridge, N. J. App. filed Jan. 4, 1918. Mechanical type.

1,307,519. BOTTLE-CAP REMOVER AND ALARM; Charles F. Scarborough, Mt. Gilead, N. C. App. filed July 12, 1918.

1,307,536. MACHINE-SWITCHING TELEPHONE SYSTEM; Henry P. Clausen, Mt. Vernon, N. Y. App. filed Apr. 12, 1917.

1,307,538. TRUNK-CIRCUIT; Hiram D. Currier, Chicago, Ill. App. filed Sept. 19, 1914.



1,307,836—Motor Controller

1,307,544. TRAFFIC-SIGNAL; Oscar A. Erdmann, Detroit, Mich. App. filed Oct. 29, 1915.

1,307,556. ELECTRIC HEATER; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Feb. 21, 1918. Luminous.

1,307,558. TELEGRAPH-REPEATER; Charles W. McKibben, Houston, Tex. App. filed Feb. 27, 1918.

1,307,572. LIGHTING-FIXTURE; Harry C. Adam, St. Louis, Mo. App. filed Oct. 8, 1918. Designed for use with a concentrated filament incandescent lamp.

1,307,575. THEFT-ALARM FOR AUTOMOBILES; Hiram A. Beall, Kansas City, Mo. App. filed July 22, 1918.

Record of Electrical Patents

Notes on United States Patents

1,307,587. ELECTRICAL HEATING UNIT; Frank Huhn and Jay A. Hand, Detroit, Mich. App. filed Jan. 18, 1917. Resistor is supported in a refractory insulator base.

1,307,589. AUTOMATIC TELEPHONE-EXCHANGE; Frank A. Lundquist, New York, N. Y. App. filed Aug. 28, 1916.

1,307,615. FOOT-WARMER; Clarence H. Buchanan, Washington, D. C. App. filed Aug. 21, 1918. Made of incandescent lamps.

1,307,620. WIRE-WINDING MACHINE; Newton Crane, Boston, Mass. App. filed Apr. 1, 1915. For winding the coils of armatures.

1,307,628. LOCK-OPERATED CIRCUIT-CLOSER; Herman Gottesman, New York, N. Y. App. filed Feb. 17, 1919. Electric alarm system.

1,307,643. RHEOSTAT; Harris D. Stone, New Haven, Conn. App. filed Feb. 8, 1918. To control the speed of a small electric motor.

1,307,644. MEANS FOR LIGHTING AND EXTINGUISHING GAS-LAMPS; Frederick James Swanston, Christchurch, New Zealand. App. filed Oct. 29, 1915.

1,307,645. X-RAY-TUBE CURRENT-MEASURING SYSTEM; Harry F. Waite, Whitestone Landing, N. Y. App. filed July 11, 1916.

1,307,651. INTERCOMMUNICATING TELEPHONE LOCKOUT SYSTEM; Frank W. Adsit, Chicago, Ill. App. filed July 29, 1916.

1,307,654. MEANS FOR LOCALIZING FOREIGN SUBSTANCES WHICH HAVE BECOME EMBEDDED IN THE HUMAN BODY; Jean Bergonie, Bordeaux, France. App. filed Aug. 16, 1915.

1,307,688. TELEPHONE SYSTEM; Frank A. Lundquist, New York, N. Y. App. filed Dec. 2, 1916.

1,307,716. CONDENSER FOR IGNITION-MAGNETOS; Ernest Ansley Watson, Coventry, Eng.

1,307,725. RELAY; Elmer R. Coe, Wilkinsburg, Penn. App. filed Sept. 12, 1917. Railway signaling systems.

1,307,738. BAKED CARBON ARTICLE; Arthur T. Hinckley, Niagara Falls, N. Y. App. Jan. 9, 1917.

1,307,740. TABULATING-MACHINE; Clair Dennison Lake, Binghamton, N. Y. App. filed Aug. 16, 1918.

1,307,742. OBTAINING OF UNIDIRECTIONAL HIGH-TENSION DISCHARGES; Oliver Joseph Lodge, Edgbaston, Birmingham, Eng. App. filed Dec. 13, 1913.

1,307,748. ELECTRIC SWITCH; Charles J. Klein, Milwaukee, Wis. App. filed Aug. 26, 1912. Feed-through.

1,307,753. SIGNALING SYSTEM; Charles Stanley Rhoads, Jr., Indianapolis, Ind. App. filed Aug. 27, 1917.

1,307,768. AUTOMATIC LOCKING DEVICE FOR ELECTRIC-FURNACE REGULATORS OF THE THURY TYPE; John Young, Welland, Ontario, Canada. App. filed Jan. 11, 1919.

1,307,773. MAGNETIC HEATER; Charles S. Cushman, Barre, Vermont. App. filed May 31, 1918. Heats substance in pipe line.

1,307,782. TRENCH FOUNTAIN-PEN; Abraham Lawres, Brooklyn, N. Y. App. filed June 20, 1918. Illuminates limited area.

1,307,791. IMPULSE-STARTER; Pontus Ostenberg, Santa Clara County, Calif. App. filed Apr. 3, 1919.

1,307,810. VEHICLE CONTROL; Justus B. Entz, Cleveland, Ohio. App. filed Apr. 3, 1913.

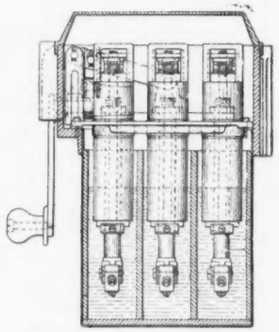
1,307,833. ELECTRIC SWITCH; Charles D. Ray and Fred Koerner, Le Mars, Iowa. App. filed Feb. 10, 1917.

1,307,836. MOTOR-CONTROLLER; Arthur Simon, Milwaukee, Wis. App. filed Jan. 2, 1915. Automatically controls planes.

1,307,845. ELECTRIC REGULATOR; William F. Bouche, Buffalo, N. Y. App. filed Mar. 15, 1916. Car lighting systems.

1,307,848. ELECTRIC SWITCH; George A. Burnham, Saugus, Mass. App. filed Feb. 5, 1916. Weatherproof safety switch.

1,307,854. ELECTRICAL-DISCHARGE-PRODUCING DEVICE; William Dubilier and Philip Dubilier, New York, N. Y.



1,307,848—Electric Switch

1,307,856. CIRCUIT-CONTROLLING BUTTON; William A. Frederick, Boston, Mass. App. filed Feb. 7, 1918.

1,307,858. MOTOR-CONTROLLER; Maurice M. Goldenstein, Milwaukee, Wis. App. filed May 22, 1916. Employed for double motor drives.

1,307,867. IGNITION-COIL; Earle P. Lee, Rochester, N. Y. App. filed July 23, 1917.

1,307,868. FLASH-LIGHT BATTERY; Anker S. Luhne, Bridgeport, Conn. App. filed Aug. 11, 1917.

1,307,869. ELECTRIC-FITTING CONNECTION; John A. McKay, Toronto, Ont., Can. App. filed Oct. 19, 1917. Insulates the fitting from the wall structure.

1,307,897. COUNTERSINKING-MACHINE; Geo. V. Curtis, Springfield, Mass. App. filed July 24, 1917.

1,307,923. SPACER FOR PENDANT ELECTRIC LIGHTS; Albert Powell, New Britain, Conn. App. filed Oct. 29, 1918. Readily applied.

1,307,927. CIRCUIT-CLOSER FOR AUTOMOBILE-SIGNALS; Girard C. Robinson, Detroit, Mich. App. filed Nov. 15, 1916.

1,307,930. PROGRESS AND APPARATUS FOR ELECTRICALLY ACCELERATING CHEMICAL REACTIONS; Walter August Schmidt and Edson Ray Wolcott, Los Angeles, Calif. App. filed May 24, 1915.

1,307,931. PROCESS OF TREATING PETROLEUM; Walter August Schmidt and Edson Ray Wolcott, Los Angeles, Calif. App. filed May 24, 1915.

1,307,933. AUTOMOBILE-THEFT SIGNAL; Antone J. Silva, Santa Maria, Calif. App. filed Aug. 31, 1917.

1,307,977. TELEPHONE SYSTEM AND APPARATUS; Alexander E. Keith, Chicago, Ill. App. filed Apr. 12, 1906.

1,307,981. LOUD-SPEAKING INTERCOMMUNICATING TELEPHONE SYSTEM; Nathan A. Kurman, New York, N. Y. App. filed Oct. 17, 1914.

1,307,995. LIGHTNING-ARRESTER; James C. Armor, Pittsfield, Mass. App. filed Mar. 2, 1912. Associated and coextensive with conductor.

1,308,000. RENEWABLE KNIFE-BLADE FUSE; John Maxwell Coote, Eliabeth, N. J. App. filed Dec. 31, 1917. Rigidity of contact blades insured.